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PROCEEDINGS
OF THE
ESSEX INSTITUTE.

VOL. V. — 1866-7.

ISSUED IN QUARTERLY NUMBERS.

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Francis Peabody.

FRANCIS PEABODY,

President of the Essex Institute,

BORN AT SALEM

December 7, 1801.

DIED AT SALEM

October 31, 1867.

OBITUARY NOTICE.

It is our painful duty to announce the death of the President of the Essex Institute, which took place at his residence in Salem, on Thursday evening, October 31, 1867.

FRANCIS PEABODY was a son of Joseph Peabody, an eminent merchant of Salem during the close of the last and the beginning of the present century. Soon after leaving school he made an excursion to Russia and Northern Europe, and on his return settled in Salem, where he continued to reside until his decease, except during occasional visits to Europe. He was early interested in the study of chemistry and the kindred sciences, and their application to the useful arts. He was the first President of the Board of Trustees of the Peabody Fund for the promotion of science and useful knowledge in the County of Essex; a member of the American Academy of Arts and Sciences, and other institutions.

In November, 1827, the Essex Lodge of Free and Accepted Masons, in Salem, of which body he was an honored member, voted to have a course of Literary and Scientific Lectures; about the same time the Salem Charitable Mechanic Association appointed a committee to provide for the delivery of lectures before the members and their families. Before both of the above-named institutions Mr. Peabody delivered several lectures on the Steam Engine, Electricity, Galvanism, Heat, and similar subjects. At the organization of the Salem Lyceum in January, 1830, Mr. Peabody took a leading part, and was on the first board of management, and delivered several lectures on scientific subjects. These several institutions may be considered as having made the first movement in the general introduction of popular and instructive lectures, which have been so universally adopted in this country.

About 1826 Mr. Peabody engaged in the manufacture of white lead, which business he pursued until 1843. During that period he was also interested in the manufacture of paper and linseed oil, and owned establishments for the refining of sperm and whale oils. From that

time, until his decease, he engaged extensively in commercial enterprises, in connection with one of his sons, and had recently erected a mill for the manufacture of gunny cloth on new principles.

Mr. Peabody had a very active and inventive mind, and was always interested in the conducting of experiments in the Physical Sciences, or in the invention of machinery useful in the arts. He had always been an efficient and zealous member of the Institute, and in May, 1865, was elected its President; during his official connection with that body he contributed very largely for the promotion of its objects.

The decease of the President will not only be a great loss to the Institute but to the community in which he had spent an active and useful life. His memory will long be cherished for his many virtues and his great interest in all worthy undertakings.

At a meeting of the Essex Institute, held on Saturday, Nov. 2, 1867, Vice-President A. C. Goodell, jr., in the chair, the following Resolutions, offered by Henry Wheatland, were unanimously adopted:—

Resolved,— That the Essex Institute receives the tidings of the decease of its President, FRANCIS PEABODY, Esquire, with profound sorrow; that in his death it recognizes the loss, not only of its most devoted, laborious and enthusiastic chief officer, but of a friend and patron of science and the useful arts, who, while distinguished for his accomplishments in a wide field of intellectual inquiry, was indefatigable in reducing the results of his investigations to practical use; a citizen who used his liberal means to advance the welfare of his neighbors by the encouragement of industry and the discovery of new sources of profit; a man whose life was characterized by untiring devotion to those studies and pursuits which lead to the highest and most enduring prosperity of any community, and, in its more intimate and private relations, was pure and blameless.

Resolved,— That, as a mark of respect to the memory of the deceased, the Rooms of the Institute be closed to the public on Monday, Nov. 4, and that the members assemble at this place on that day, at 12.30 P. M., to attend the funeral of their late President.

Resolved,— That the Hon. C. W. Upham be invited to prepare a Eulogy upon the life and character of the deceased, to be read before the members of the Institute at such time as shall be hereafter determined upon; and that the Trustees of the Peabody Fund be invited to participate in the exercises of that occasion.

Resolved,— That a copy of these Resolutions be presented to the family of the deceased, to whom the Institute hereby tenders its sincerest sympathy and condolence; and that a copy be also forwarded to George Peabody, Esquire, of London, who so much relied upon the deceased for the wise management of his large donation for the promotion of science and useful knowledge in the County of Essex; between whom and the deceased the warmest feelings of kindred and friendship existed.

PROCEEDINGS

OF THE

ESSEX INSTITUTE.

MONDAY, JANUARY 1, 1866. Regular Meeting.

Rev. G. D. WILDES in the Chair.

Letters were read from E. Suffert, Havana, Cuba; Dr. A. S. Packard, Jr., Boston Soc. of Nat. Hist.; E. S. Morse, Portland, Me.; Prof. Theo. Gill, Smithsonian Institution; Henry A. Smith, Cleveland, Ohio; George R. Bartlett, Providence, R. I.; Samuel L. Boardman, Augusta, Me.; Wm. N. Canby, Wilmington, Del.; Prof. G. C. Swallow, Columbia, Mo.; Rev. A. B. Kendig, Marshalltown, Iowa; Prof. E. D. Cope, Haverford College, Penn.; Dr. J. H. Slack, Philadelphia; W. H. Dall, of the Russian-American Telegraph Co.; R. E. C. Stearns, San Francisco, Cal.; Prof. Theo. Gill, Washington, D. C.; Rt. Rev. Thomas M. Clark, Providence, R. I.; John Russell Bartlett, Providence, R. I.; Joseph Peabody, Salem; American Philosophical Society; Pennsylvania Historical Society.

Donations to the Library and Museum were announced.

Mr. W. P. Upham read a letter from Major Benham of the U. S. Ordinance Department, requesting that an interesting and curious shot found in the bank on the shore of Winter Island, near Fort Pickering, and presented to the Institute by Mr. Williams, be deposited in the Museum of the U. S. Ordinance Department at Washington. Referred to the Board of Directors.

Mr. Putnam exhibited a collection of Fossils, made at Kelly's Island, Lake Erie, and gave an account of the Island; alluding to the kind attention he had received from Geo. C. Huntington, Esq., and other residents, during his recent visit to the Island.

The thanks of the Institute were voted to Mr. Huntington for the kind attentions and facilities for collecting afforded to the Superintendent during his visit.

MONDAY, JANUARY 15, 1866. Regular Meeting.

Vice President GOODELL in the Chair.

Letters were read from Wm. N. Canby, Wilmington, Del.; George W. Peck, New York, N. Y.; Capt. A. Hyatt, Baltimore, Md.; Dr. J. G. Thomas, Riviere-du-Loup-en-bas, C. E.; E. T. Cresson, Sect. Entomological Society of Philadelphia; Prof. E. D. Cope, Philadelphia; A. Holland, Boston; G. L. F. Ball, Rangely, Me.; G. W. Pease, Salem; Rev. E. C. Bolles, Portland, Me.; S. L. Boardman, Augusta, Me.; Jeremiah Colburn, Waldo Higginson and Governor Andrew, of Boston.

The Superintendent exhibited a collection of Massachusetts shells which had been made by Joseph True, of Salem. This collection contains nearly all the species indigenous to Massachusetts; and among them several rare and interesting species are represented by fine specimens. By the kindness of Dr. B. Pickman, this valuable collection has been purchased of Mr. True, and presented to the Institute.

Mr. E. S. Morse, of Portland, spoke of the value of the collection, and gave an interesting account of the structure of the Mollusks; the homologies of the various parts in the several orders; and the habits of a number of the more interesting and rarer species represented in the collection.

Donations to the Museum and Library were announced.

Alfred Poor, of Salem, and Francis G. Sanborn, of Andover, were elected Resident members.

MONDAY, FEBRUARY 5, 1866. Regular Meeting.

Vice President GOODELL in the Chair.

Mr. Putnam was chosen Secretary pro tem.

Letters were read from James W. Averill, Clerk of Engine Co., No. 1; Dr. H. J. Slack, Philadelphia, Pa.; E. T. Cresson, Sect. Entomological Society of Philadelphia; Dr. H. C. Wood, Jr., Acad. Nat. Sciences of Philadelphia; Prof. E. D. Cope, Acad. Nat. Sciences of Philadelphia; Prof. Richard Owen, Bloomington, Ind.; C. H. Jones, Sun Prairie, Dane Co., Wisc.; Elihu Hall, Athens, Ill.; Robert Dinwiddie, Cor. Sect. Lyceum Nat. History of New York; John Akhurst, Brooklyn, N. Y.; Charles D. Marshall, Cor. Sect. Buffalo Soc. Nat. Sciences; Geo. W. Peck, New York; C. F. Robinson, New York; O. C. Marsh, New Haven, Ct.; Dr. J. G. Thomas, Riviere-du-Loup-en-bas, Canada; Wm. Wood & Co., New York; J. W. Young, Cleveland, Ohio; W. E. Endicott, Canton, Mass.; Capt. Alpheus Hyatt, Baltimore, Md.; A. D. Brown, Smithsonian Institution; W. H. Niles, Southampton, Mass.; Henry A. Smith, Cleveland, Ohio; E. E. Barden, Rockport; J. Colburn, Boston; S. L. Boardman, Augusta, Me.; Miss Lucy Longfellow, Machias, Me.; J. J. Babson, Gloucester, Mass.; James G. Barnwell, Libr. Cincinnati Mercantile Library Association.

The Superintendent called the attention of the meeting to the large collection of Plants, Shells, and other specimens received from Mr. Elihu Hall, of Athens, Ill. With the four hundred species of Plants, donated by Mr. Hall, were a number of cones of several species of Rocky Mountain Pines

and Spruces, and, as the Institute had also recently received several photographs of the "Big trees" of California, *Sequoia gigantea* Torrey, as well as specimens of their cones, leaves, bark and wood he gave an account of the forest trees of the Rocky Mountain region, especially of the Spruces, Pines and Redwoods of which specimens were on the table; exhibiting a number of plates, taken from the several volumes of the Pacific R. R. Survey, which illustrated these trees. He also called attention to the important work which had been done by the Government to advance science, as shown by the valuable volumes of the Pacific R. R. and the Mexican Boundary Surveys.

The thanks of the Institute were voted to Mr. Hall for his valuable donation.

Donations to the Library and Museum were announced.

Ex-Governor John A. Andrew, of Boston, was elected a Corresponding member. Rev. James O. Scripture, of Salem, was elected a Resident member.

MONDAY, FEBRUARY 19, 1866. Regular Meeting.

Vice President GOODELL in the Chair.

F. W. Putnam was chosen Secretary pro tem.

Letters were read from Prof. G. C. Swallow, Columbia, Mo.; F. F. Hodgman, Littleton, N. H.; Franklin B. Hough, Lib. Albany Institute; Prof. Theo. Gill, Smithsonian Institution; Prof. G. H. Cook, Rutgers College; Prof. S. Tenney, Vassar College; Prof. W. E. A. Aikin, University of Maryland; Joseph E. Chase, Holyoke, Mass.; Hiram A. Cutting, Lunenburg, Vt.; Vincent Barnard, Kennett Square, Pa.; N. S. Shaler, Museum Comp. Zoology; E. Steiger, New York; Samuel G. Drake, Boston, Mass.; Wm. J. Beal, Union Springs, N. Y.; Prof. D. S. Sheldon, Griswold College; A. L. Babcock, Sherborn, Mass.; N. Vickary, Lynn, Mass.; C. M. Tracy, Lynn, Mass.; Henry A. Smith, Salem; A. G. Browne, Savannah, Ga.; Desmond Fitz Gerold, Providence, R. I.; J. Wingate Thornton, Boston, Mass.; Hon. John A. Andrew, Boston, Mass.

The Secretary read, by title, a communication from Dr. A. S. Packard, Jr., entitled "*Descriptions of the Larvæ, and Notes on the Habits of some species of Hymenoptera, with figures.*" Referred to the Publication Committee.

R. S. Rantoul read a communication giving the history of the Seal of the City of Salem. He also presented, in the name of George Peabody, Esq., the original design of the City Seal, drawn by Mr. Peabody, and also the first impression of the seal in wax, taken by the engraver.

The thanks of the Institute were voted to Mr. Peabody for his valuable donation, and Mr. Rantoul's communication was referred to the Committee on publication.

Rev. G. D. Wildes made a few remarks on the relation of seals to history, and a general discussion followed on the use of the word "Salem," on the City seal, instead of "Solyma," as given in the design by Mr. Peabody.

Mr. Goodell read a communication by M. A. Stickney, entitled "*Almanacs and their authors.*" Referred to the Publication Committee.

Remarks, relating to the various kinds of almanacs and their uses, were made by Messrs. Rantoul, Upham, Wildes and Goodell.

It having been stated that Mr. Lamson, of this city, had kept a record of the weather for many years, it was voted that the Superintendent be requested to ascertain if Mr. Lamson would allow the Institute to publish such parts of his record as might be of value to meteorological science.

Mr. Wildes presented a request from Mr. Guild for a drawing of the "First Church," for publication in his work on Roger Williams. Referred to the Curators of the Historical Department.

Donations to the Museum and Library were announced.

MONDAY, MARCH 5, 1866. Regular Meeting.

Vice President GOODELL in the Chair.

Letters were read from Prof. B. F. Mudge, Kansas State Agri. College, Manhattan, Kansas; Prof. Theo. Gill, Smithsonian Institution; N. S. Shaler, Museum Comp. Zoölogy, Cambridge; Prof. James Bushee, Worcester Society of Natural History; Hiram A. Cutting, Lunenburg, Vt.; Henry d'Aligny, Houghton, L. S., Mich.; Edw. S. Morse, Portland, Me.; Prof. Wm. E. A. Aikin, Baltimore, Md.; G. K. Gilbert, Rochester, N. Y.; E. Steiger, New York, N. Y.; Prof. L. Harper, New York, N. Y.; E. N. Bartlett, Four Corners, Ohio; S. H. Scudder, Dresden, Saxony; Prof. P. D. Bradford, Northfield, Vt.; G. C. Broadhead, Pleasant Hill, Mo.; C. A. Schott, Ass't U. S. Coast Survey; John C. Trautvine, Philadelphia, Pa.; Benj. S. Lyman, Philadelphia, Pa.; Hon. Isaac Newton, Commissioner U. S. Agricultural Department; W. W. Denslow, Inwood, N. Y.; O. M. Holmes, Boston; G. W. Pease & Co., Salem; Charles Darwin, Bromley, Eng.; Horace P. Chandler, Chicago, Ill.; J. Wingate Thornton, Boston; E. E. Barden, Rockport; Henry A. Smith, Cleveland, Ohio; A. Agassiz, Cambridge; Joel Munsell, Albany, N. Y.; Rev. T. W. Higginson, Newport, R. I., Royal Society, London; S. L. Boardman, Augusta, Me.

Mr. Putnam exhibited several specimens of a species of Two-Spined Stickleback, collected by the late Dr. Richard H. Wheatland at Nahant, on April 15th, 1859. This species differs from *Gasterosteus biaculeatus* in having the sides of the body posterior to the second dorsal spine free of plates or scales, of which there are from six to eight on the anterior part. The tail is not carinated as in *Gasterosteus biaculeatus*, neither has it the fleshy ridge characteristic of *Gasterosteus Cuvieri*; but is smooth as in *Gasterosteus quadracus*. The size of the fish is a little over one-half that of *Gasterosteus biaculeatus*, and its general appearance is short and deep. For this species, which he thought as yet undescribed, he proposed the name of *Gasterosteus Wheatlandi*, in memory of its discoverer, and he would offer a description and figure of it at a future meeting.

Mr. Putnam also gave an account of the habits of the several species of Sticklebacks found in our waters, and described the nests of *G. biaculeatus* and *G. quadracus*.

Donations to the Museum and Library were announced.

Prof. Benjamin Silliman; Prof. James D. Dana; Prof. W. H. Brewer, and Prof. George J. Brush, of New Haven, Ct.; A. E. R. Agassiz, of Cambridge; Prof. Joseph Leidy; Dr. John L. LeConte; Isaac Lea, LL.D., and T. A. Conrad, of Philadelphia, Pa.; Professor Joseph Henry, Sect. Smithsonian Institution; Prof. Jared P. Kirtland, of Rockport, Ohio; and Thomas Bland, Esq., of New York, were elected Corresponding members.

MONDAY, MARCH 19, 1866.

Vice President GOODELL in the Chair.

Letters were read from G. C. Broadhead, Pleasant Hill, Mo.; Maj. Gen. Alfred Sully, U. S. A., Clinton, Iowa; Dr. A. S. Packard, Boston Society of Natural History; F. G. Sanborn, State Cabinet, Boston; John Akhurst, Brooklyn, N. Y.; Edward Pickering, Boston; Prof. John F. Marshall, Tufts' College; W. H. Niles, New Haven, Ct.; Robert Howell, Nichols, N. Y.; Prof. J. W. Dawson, Montreal, Canada; Dr. N. T. True, Bethel, Me.; Prof. B. F. Mudge, Kansas State Agricultural College; G. K. Gilbert, Rochester, N. Y.; Capt. Alpheus Hyatt, New York, N. Y.; John G. Anthony, Asst. Museum Comparative Zoölogy, Cambridge, Mass.; T. A. Cheney, Havana, N. Y.; Prof. Charles S. Stone, Cooper Union, New York, N. Y.; Prof. Chas. E. Hamlin, Waterville College, Me.; Prof. J. P. Lesley, University of Penn.; S. Jillson, Feltonville, Mass.; James M. Shaw, South Waterford, Me.; James Lewis, Mohawk, N. Y.; W. M. Hunting, Fairfield, N. Y.; Henry Englemann, Belleville, Ill.; Chas. D. Marshall, Corresp. Sect. Buffalo Society Natural Sciences; Dr. E. W. Hubbard, Tottenville, N. Y.; Abijah Bradley, New Haven, Ct.; James P. Kimball, New York, N. Y.; F. R. Howland, Irvington, N. Y.; H. M. Bannister, Evanston, Ill.; J. D. Parker, Steuben, Me.; T. A. Conrad, Philadelphia, Pa.; Col. R. B. Marcy, U. S. A.; Prof. Chr. Johnston, University of Md.; Prof. W. D. Moore, Irwin's Station, Pa.; H. A. Green, Mt. Morris, N. Y.; Prof. H. A. Ward, Rochester University, N. Y.; Prof. H. J. Clark, Cambridge; Thomas Devino, Ottawa City, Canada; John Gebhard, Jr., Schoharie, N. Y.; Henry Rousseau, Troy, N. Y.; U. S. Coast Survey; John G. Hodgkins, Education Office, Toronto, C. W.; Richard Hamant, Worcester Society of Natural History; Albert D. Hager, State Geologist of Vt.; Prof. J. D. Dana, Yale College; Dr. A. M. Leonard, Lockport, N. Y.; U. S. Bureau of Navigation; Dr. B. F. Shumard, St. Louis, Mo.; Prof. E. J. Pickett, Attica, Ind.; L. B. Case, Richmond, Ind.; A. Agassiz, Museum Comp. Zoölogy; Dr. Carl Rominger, Ann Arbor, Mich.; A. M. Edwards, President Am. Microscopical Society, New York; U. P. James, Cincinnati, Ohio; E. F. Cox, New Harmony, Ind.; M. C. Fernald, South Levant, Me.; Dr. J. H. Slack, Philadelphia, Pa.; J. W. Foster, Chicago, Ill.; Prof. A. Litton, St. Louis Medical School; Alpheus Hyatt, Baltimore, Md.; Prof. J. M. Safford, State Geologist of Tennessee, Nashville, Tenn.; Prof. Theo. Gill, Smithsonian Institution; H. M. Raynor, New York; Prof. Joseph Henry, Sect. Smithsonian Institution; Dr. Charles Tufts, Dover, N. H.; E. W. Hilgard, State Geologist of Miss., Oxford, Miss.; New York Historical Society; Smithsonian Institution; New England Historic-Genealogical Society; Boston Mercantile Library Association; The President and Trustees of Bowdoin College; Iowa State Historical Society; Chicago Historical Society; Jeremiah Colburn, Boston; Wm. Graves, Newburyport; Capt. N. E. Atwood, Provincetown.

Donations to the Library and Museum were announced.

The Superintendent, on announcing the donations to the Museum, called special attention to the valuable collection of shells presented by the Smithsonian Institution, and to the plaster casts of the head of *Gorilla castaniceps* Slack, and of the skull of *Chæropsis liberiensis* Leidy, presented by Dr. J. H. Slack, of Philadelphia. He also gave an account of the structure and habits of a fish, a species of *Multhea*, from Cuba, presented by Nathaniel Kinsman.

Henry A. Smith, of Salem; Gilbert Hawkes, of Lynn; and Micajah B. Mansfield, of Salem, were elected Resident Members.

The following persons were elected Corresponding Members: Prof. J. E. Holbrook, of Charleston, S. C.; Prof. Christopher Johnston, of Baltimore, Md.; Prof. G. C. Swallow, of Columbia, Boone Co., Mo.; Prof. J. D. Whitney, State Geologist of California; F. B. Meek, of Washington, D. C.; Elihu Hall, Athens, Ill.; Bvt Col. Francis N. Clarke, U. S. A.; Dr. A. Kellogg, of San Francisco, Cal.; P. R. Uhler, of Baltimore, Md.; and Prof. H. James Clark, of Cambridge, Mass.

*Additions to the Museum and Library during January,
February and March, 1866.*

TO THE NATURAL HISTORY DEPARTMENT.

BY DONATION.

BABBIDGE, C. A., Salem. Malformed Egg of Domestic Fowl.

BALL, G. L. F., Rangely, Me. Skeleton of a young Black Bear, *Ursus americanus* Pallas, from Rangely.

BECKETT, A. H., Salem. Teeth of a Skate, from Salem. 12 Oyster Crabs, *Pinnotheres ostreum*.

BOARDMAN, G. A., Milltown, Me. Antlers of Woodland Caribou, *Rangifer Caribou*, from Canada.

BOLLES, REV. E. C., Portland, Me. 124 specimens, 19 species, Land and Fresh water Shells, from Maine, Ohio, Pennsylvania and Cuba. 112 specimens, 45 species, Spiders and Insects. 10 specimens, 3 species, Salamanders; Tadpoles of *Hylodes*: young *Gasterosteii*, from vicinity of Portland, Me.

BRIGGS, MRS. J. B., Salem. 28 specimens, 23 species, of Shells from various localities.

CARPENTER, J. C., Salem. Massive Emery, from Chester, Mass.

CHOATE, HON. F. W., Beverly. Large specimen of Porcupine Fish, *Diodon* sp.?, from the South Atlantic?

CLARK, N. A., Salem. Antlers of a Moose, *Alce americanus* Jard., from Three Rivers, Canada.

COOKE, CALEB, Salem. Hydroids, from under Beverly Bridge. Bud of the Banana Tree, *Musa* sp., from Zanzibar, Africa.

GARDNER, HENRY R., Salem. 2 Beetles from Brazil.

HALL, ELIHU, Athens, Ill. A collection of about 400 species of Rocky Mountain and Western Plants. Cones of *Pinus ponderosa*, *P. contorta*, *Abies Menziesii* and *A. Douglasii*. Lignite, from Rocky Mountains. Incrustation of Soda, from the Soda spring near Pike's Peak. A large collection of Land and Fresh-water Shells, from the Rocky Mountains and Illinois. 5 Field Mice; 1 Shrew; 12 specimens, 10 species, of Reptiles; 9 specimens, 3 species, of Fishes; 12 *Astacus*; from Athens, Ill.

HASKELL, CAPT. ELIJAH, Salem. Coral, *Orbicella cavernosa*, from the Water Battery of Vera Cruz.

HENFIELD, JOHN, JR., San Francisco, Cal. By Miss MARTHA H. CHISHOLM. 4 Photographs of the "Great Trees" of California. Surface Bark and piece of the Wood of the "Father of the Forest." Section of Bark from a living tree of the same group.

JONES, C. H., Sun Prairie, Wis. Skull of a full grown Prairie Wolf, *Canis latrans* Say, from Columbia Co., Wis.

KIMBALL, MISS SUSAN, Salem. 4 species, 10 specimens, of Shells, from West Indies.

KINSMAN, NATHANIEL, Salem. *Multhea* sp. from Harbor of Cienfuegos, Cuba.

LE GRAND, CHARLES, Salem. *Natica duplicata*, from New Bedford. Large number of specimens of *Athirina notata*, from Salem. Bird from Africa. Large Fungus, from Gloucester.

MANNING, JAMES, Salem. 2 Flying Fishes, *Exocoetus* sp., from the South Atlantic.

OWEN, PROF. RICHARD, Bloomington, Ind. 180 specimens, 62 species, of Upper and Lower Silurian, Devonian, Carboniferous, Oölitic and Tertiary Fossils; 22 specimens of Minerals, from various localities.

PICKMAN, BENJAMIN, Salem. The "TRUE Collection" of Massachusetts Shells. 3 specimens of *Perca*, 3 of *Lota*, 2 of *Esox*, 1 of *Leuciscus*, 4 of *Leucoperca*, from Lake Champlain.

WILLIAMS, W. A., Chelsea. Fossil Shell, from Gay Head.

PRESCOTT, JOHN, Grafton, N. H. Log Cock, *Hylotomus pileatus* Baird, from Grafton.

RILEY, DANIEL, Salem. Collection of Shells and Corals, from Zanzibar and Mozambique, Africa.

ROBINSON, JOHN, Salem. A small collection of Nests and Eggs of Essex Co. Birds. Teeth of a Shark and of a Skate, from Massachusetts Bay.

SHEPARD, H. F., Salem. Blue Jay, *Cyanurus cristatus* Sw., and female of Pine Grosbeak, *Pinicola canadensis* Cab., from Grafton, N. H.

SKERRY, HENRY F., Salem. 18 specimens, 18 species, Eggs of Essex Co. Birds.

SLACK, DR. J. H., Philadelphia, Pa. Plaster casts of head of *Gorilla castaneiceps* Slack, and skull of *Chacopsis liberiensis* Leidy.

SMITHSONIAN INSTITUTION, Washington, D. C. A large collection of Shells from Jamaica, Panama, Mazatlan, Cape St. Lucas, California and Vancouver. Identified by Dr. P. P. Carpenter. Also a set of the duplicate Shells of Wilkes' United States Exploring Expedition.

SMITH, J. FORD, Salem. Abnormal Egg of Domestic Fowl.

STEARNS, A. E. R., San Francisco, Cal. An identified collection of Californian and Mexican Shells.

TRASK, AMOS, South Danvers. Malformed Egg of Domestic Fowl. Specimen of "Padding Stone," from Roxbury.

WILDES, G. D., Salem. Japanese Tobacco.

TO THE HISTORICAL DEPARTMENT.

BY DONATION.

BROWNE, ALBERT G., Salem. Iron Cap to Pile, used by the Confederates in the Defence of the Savannah River.

HASKELL, CAPT. ELIJAH, Salem. Mexican gun-lock, (flint). Piece of the truck of the Flag-Staff of the Water Battery at Vera Cruz.

KIMBALL, JAMES, Salem. 2 Coins.

LEACH, WILLIAM, Salem. Indian Sinkers dug up in Turner St., Salem.

LE GRAND, CHARLES, Salem. Military button.

PEABODY, GEORGE, Salem. The original design, and the first impression in wax of the Seal of the City of Salem.

PERKINS, GEORGE, Salem. \$100 00, \$20 00 and \$2 00 Confederate bank bills.

RELIANCE ENGINE CO., No. 1, Salem. Bust of Webster.

ROBINSON, JOHN, Salem. Several Historical relics.

ROPER, MISS SUSAN, Salem. Earthen Water Jar; Native Sandals from Zanzibar. 3 Coins.

SHEPARD, HENRY F., Salem. 2 Wristers, worn by Mrs. Webb, 130 years ago.

WILLIAMS, JAMES S., Salem. Sabre surrendered by the Confederates at Tallahassee, Florida. A "Bushwhacker's" accoutrements.

TO THE LIBRARY.

BY DONATION.

BEMIS, M. E., Boston. 7 Pamphlets.

BOARDMAN, SAMUEL L., Augusta, Me. Holmes' Agricultural Address, Oct. 20, 1864, 8vo, pamph. Proceedings at Convention of Publishers, &c., of Maine, 1864, 8vo, pamph. Boardman's Agricultural Survey of Somerset Co., Maine, 8vo, pamph. Boardman on the Agriculture and Industry of Kennebec Co., Me., 8vo, pamph. Maine Farmer for 1862, 3 and 4, 3 vols., folio. Triweekly Journal and Age for 1836, 1 vol., folio, Augusta. Universalist Union, vols. 2, 3 and 4, 3 vols., 4to, New York, 1836-9.

Transactions N. Y. Agricultural Society for 1862 and '63, 2 vols., 8vo, Albany. 8th and 9th Annual Report of Sec'y of Me. Board of Agriculture, 2 vols., 8vo, Augusta, 1863 and '4. **Drew's Glimpses and Gatherings at London, and the Great Exhibition of 1851**, 1 vol., 12mo, Augusta, 1852. 3d, 5th, 9th, 10th, 11th and 12th Annual Rep. of Supt. of Common Schools of Me., 6 pamphlets, 8vo. **Watson's Treatise on Practical Husbandry**, 8vo, pamph. 22 miscellaneous Pamphlets.

BOSTON, CITY OF. Boston City Documents for 1865, 2 vols., 8vo.

BOWDITCH, HENRY L., Boston. Memorial of N. Bowditch, 1 vol. 4to, Boston, 1865.

BROADHEAD, G. C., Pleasant Hill, Mo. Coal Measures in Missouri by G. C. Broadhead, 8vo, pamph., 1866.

BROOKS, HENRY M. A Journal of the Travels and Sufferings of Daniel Saunders, 16 mo, 1 vol., Salem, 1794. A collection of Handbills, &c., &c.

COLE, MRS. N. D. Boston Daily Traveller for 1865, 2 vols., folio, Salem Gazette for 1865, 1 vol., folio.

COUFER, WILLIAM, Quebec. Manuscripts relating to the Early History of Canada, 8vo, pamph., Quebec, 1866.

ELIOT, JOHN F., Boston. 55 Pamphlets. Several old Newspapers.

FOOTE, CALB. Files of several County Papers for the past three months.

FOSTER, J. W., Chicago, Ill. Geology and Metallurgy of the Iron Ores of Lake Superior, &c., 8vo, pamph. Report of Oakland Company, 8vo, pamph., 1865. Report of Peninsular Lead Mining Co., 8vo, pamph., 1865. Report on the Coal and Salt Lands of Marietta Run, 8vo, pamph., 1866. Report of New Diggings and Shullsburg Mining Co., 8vo, pamph., 1864.

GREEN, SAMUEL A., Boston. 140 Pamphlets.

HAMLIN, C. E., Waterville, Me. Catalogue of Birds found in the vicinity of Waterville, Me., by C. E. Hamlin, 8vo, pamph.

HANAFORD, MRS. P. A., Reading. Abraham Lincoln, his Life and Public Services, by Mrs. P. A. Hanaford, 1 vol., 12mo, Boston, 1865. Report of School Committee of Reading, 8vo, pamph., Boston, 1866. Statement of Receipts and Expenditures of Reading, 8vo, pamph., Boston, 1866.

HARRIS, NATH'L B. Ross's American-Latin Grammar, 1 vol., 16mo. Newburyport, 1780.

HILL, THOMAS, President of Harvard College. Annual Report of the President and Fellows of Harvard College, 1864-5, 8vo, pamph., Cambridge, 1866.

HOLDEN, N. J. Supplement to Ichology of Massachusetts, by E. Hitchcock, 1 vol., 4to, Boston, 1865.

HOOPER, HANNAH. Braser's Sermons, 1 vol., 12mo, Boston, 1849, "Our Book," 1 vol., 12mo.

HUGUET-LATOURE, L. A., Montreal, C. E. Constitution and By-Laws of the Numismatic Society of Montreal, 16mo, pamph., 1863.

LEA, ISAAC, Philadelphia. Collection of Papers on the Mollusca, by Isaac Lea, LL.D., 8vo, pamph.

LEWIS, WINSLOW, Boston. Annual Report of Mass. Gen. Hospital for 1865, 8vo, pamph. Valedictory Address to N. E. Hist. Gen. Society, Feb. 7, 1866, 8vo, pamph.

LORD, N. J. Boston Post, for Oct., Nov. Dec., 1865.

LORING, GEORGE B. Boston Daily Post, 1865.

MUDGE, BENJ. F., Quindaro, Kansas. Six Public Documents of Kansas.

NEWTON, ISAAC, Commissioner of Agriculture. Report on Agriculture for 1862, 1863, 1864, 3 vols., 8vo, Washington. Monthly Report of the Department of Agriculture for Jan'y and Feb., 1866, 8vo, pamph.

NICHOLS, GEORGE. Files of Christian Enquirer from Jan. 1 to Oct., 1865.

OWEN, RICHARD, Bloomington, Ind. Hopkins' Discourse on Lincoln, at Bloomington, Ind., April, 19, 1865, 8vo, pamph. Owen's "The Journey of Life," an Allegorical Sketch, March 12, 1865, 8vo, pamph.

PAINE, N., Worcester. The Worcester Directory for 1866, 1 vol., 8vo.

PARISH, ARIEL, New Haven, Conn., Annual Report of Board of Education, 1865, 8vo, pamph.

PICKMAN, BENJAMIN. The Nation, Jan., Feb. and March, 1866.

PICKMAN, WILLIAM R. Lambert's Sermon at St. John's Church, Jan. 7, 1866, 8vo, pamph. Bolles' Sermon on 1st Sunday in Advent, 1865, 8vo, pamph.

PUTNAM, GEORGE D. Remarks on Howell's Patent Homogeneous Steel, 8vo, pamph., Boston, 1864.

SHEPARD, HENRY F. 3 Pamphlets.

SIMPSON, JAMES H., Lt. Col. Engineer Corps, U. S. A. Report on the Pacific Railroad and Branches, &c., Nov. 23, 1765, 8vo, pamph.

SNOW, E. M., Providence, R. I. 12th Report of the Registration of Births, Marriages and Deaths in Rhode Island, 8vo, pamph., Providence, 1866.

STONE, BENJ. W. The New York Civil List, 1865, 1 vol., 12mo., Albany, 1865. Manual for the use of New York Legislature, 1865, 1 vol. 16mo., Albany, 1865. 8th Annual Rep. of Board of Commissioners of the Central Park, 1 vol. 8vo, New York, 1865.

STONE, E. M., Providence, R. I. 24th Annual Rep. of the Ministry at Large, Providence, R. I., 8vo, pamph.

SUMNER, CHARLES, U. S. Senator. Message and Documents Abridged 1864-5, 1 vol., 8vo. Official Army Register for 1864 and '65, 2 pamphs. Report of Commissioner of Agriculture for 1864, 1 vol., 8vo. Report of Com-

mittee on the Conduct of the War, 3 vols., 8vo. Agriculture of United States in 1860, 1 vol., 4to, Pub. Doc. Report of Committee on the attack on Petersburg, 30 July, 1864, 1 vol., 8vo, Pub. Doc.

TRUBNER & Co., London. Trübner's American and Oriental Literary Record for Jan., Feb., March, 1866.

TUCKER, JONATHAN. 25 Almanacs of various years.

U. S. CONGRESS LIBRARY. Alphabetical Catalogue of the Library of Congress, 1 vol., 8vo., Washington, 1864.

UNITED STATES, SURGEON GENERAL'S OFFICE. Circular No. 6, 1 vol., 4to. Reports on the Extent and Nature of the Materials for a Medical Surgical History of the Rebellion, 4to, pamph.

WATERS, JOSEPH G. 29th Auditor's Report of Milton, 8vo, pamph., Boston, 1866.

WINCHELL, A., Ann Arbor, Mich. 1st Biennial Report on Geol. Survey of Michigan, 1 vol., 8vo, Lansing, 1861. Report on Museum of Univ. of Michigan, 8vo, pamph., 1864. Address on the Prairies of Mississippi Valley, 8vo, pamph. 6 Pamphlets.

BY EXCHANGE.

AMERICAN ACADEMY OF ARTS AND SCIENCES. Proceedings vol. VI., pages 365 to end of vol.

AMERICAN ANTIQUARIAN SOCIETY. Proceedings of Annual Meeting, Oct. 21, 1865, 8vo, pamph.

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MONDAY, APRIL 2, 1866. Regular Meeting.

JAMES KIMBALL, Esq., in the Chair.

Letters were announced from Prof. Henry How, King's College, Windsor, N. S.; W. S. West, Salem; Prof. Robert Bell, Kingston, C. W.; Prof. Jos. Moore, Richmond, Ind.; Mrs. O. Marcy, Evanston, Ill.; B. P. Mann, Cambridge; G. K. Gilbert, Rochester, N. Y.; Rev. Samuel Lockwood, Keyport, N. J.; Prof. J. H. Salisbury, Cleveland, Ohio; I. A. Lapham, LL. D., Milwaukee, Wis.; S. B. McMillan, East Fairfield, Ohio; C. D. Marshall, Corresp. Sect. Buffalo, Soc. Nat. Sciences; Dr. Wm. Sharswood, Philadelphia, Pa.; Dr. James Knapp, Louisville, Ky.; Dr. Theodatus Garlick, Cleveland, Ohio; Prof. Theo. Gill, Smithsonian Institution; P. R. Uhler, Cambridge; Prof. Robert Peter, Lexington, Ky.; Prof. Theo. Parvin, Iowa State University; O. C. Marsh, New Haven, Ct.; Dr. Edward Ravenel, Charleston, S. C.; George W. Holden, Dayton, Ohio; Dr. A. S. Packard, Boston Soc. Nat. History; Rev. J. A. Swan, Keenebunk, Me.; Prof. A. E. Verrill, Yale College; Smithsonian Institution, Washington, D. C.; Prof. F. S. Holmes, College of Charleston, S. C.; Prof. S. Tenney, Vassar College, N. Y.; Christopher Johnson, Baltimore, Md.; Geo. Peabody Russell, Haverhill; R. Damon, Weymouth, Eng.; A. C. Chandler, New Gloucester, Me.; Thomas Bland, New York; Iowa State Historical Society; Newburyport Public Library; New York Lyceum of Natural History; Dr. S. A. Green, Boston; Minnesota Historical Society; A. Agassiz, Cambridge; Isaac Lea, LL. D., Philadelphia; Prof. Geo. J. Brush, New Haven, Conn.; E. F. Beadle, New York; L. A. Swasey, Salem; Prof. W. H. Brewer, Yale College; Thomas H. Webb, Boston; Boston Public Library.

James Kimball read a communication relating to the witchcraft papers in the Salem Court House, Boston and other places; copies of many of which have been made by order of the County Commissioners of Essex Co., and are now deposited in the Salem Court House, forming a valuable addition to the records of those trials.

Mr. Kimball also read the petition of George Herrick, of Salem, for services relative to witchcraft as Marshall and Deputy Sheriff of Essex County; also the Inventory of the Estate of Philip English, which was confiscated at the time of his prosecution for witchcraft.

The propriety of printing all papers that can be obtained relating to the Witchcraft trials in this County was discussed, and a motion was adopted appointing a Committee of three to take the subject into consideration and report at a future meeting. Messrs. H. M. Brooks, W. P. Upham and James Kimball were chosen as the Committee.

Francis G. Sanborn, of Andover, gave an account of the method of communicating ideas among insects by means of their antennæ. He stated that while collecting in Norfolk County early in the spring of 1865, his attention was called to an irregular black mass about the size of one's doubled fists, apparently resting on the top of the spires of grass, then about four inches high, in a pasture. On approaching, it was found to consist of small black ants clinging to each other, and supporting the mass by their united strength, so that it rested on the ground only at its centre. On separating them gently with the fingers, an oval cluster of eggs was revealed, which

they were holding some three-quarters of an inch from the ground, apparently for the purpose of drying, as the weather had been wet for several days, and the morning was dark and lowery, the sun appearing only at long intervals, with a strong wind blowing. On removing the hands, the ants again closed over the cluster of eggs (which was about the size of the last joint of the thumb) and the continual changing of their places by the little creatures gave the mass an appearance of ebullition. I dropped upon the centre of this mass a large species of ant, of a light yellow color, belonging to a different genus, which I had taken from beneath a stone near the spot. It was pounced upon in an instant by some dozen or more of the black species, but made no resistance, simply folding its feet and waving its antennae slowly in a manner which it required no stretch of the imagination to interpret as deprecatory, as who should say, "I humbly beg pardon for intruding; 'twas no fault of mine; accident, or a stronger will than mine placed me here, and if you will allow me to depart, I will gladly do so, and trouble you no more." As if in answer to this or a kindred appeal, it was released, and passed out over the bodies of the blacks until it reached a large stone just touching the mass on which were a few scattered blacks, like an outpost of the main body. Here it was again seized and somewhat roughly handled by four or five of these sentinels, but a repetition of its passive protest secured once more its freedom, and it disappeared from sight in the grass. Another insect, the *Simulium molestum*, or "Black-fly" of our northern forests, happening to alight upon my hand, was then dropped among them. He was seized upon and torn limb from limb in a few seconds, his mangled remains filtering down through the mass to the earth. Again and again the experiment was tried with the yellow species of ant, and invariably with the same result; they were always allowed to pass away without injury, upon examination, although as quickly seized at first as the unfortunate "Black-fly." A spider, two gnats, and a small plant-bug were then successively dropped into the seething mass, and as thoroughly dismembered and demolished as the first victim. These experiments occupied nearly two hours, during which my eyes were so close to the theatre of action that scarcely a motion of the prisoners or their assailants escaped me, and I was fully convinced that the language of the antennae, while it may be understood among allied species and genera, has its limits, and that insects of different orders bear some such relations to each other as do human beings of different nationalities.

Capt. N. E. Atwood, of Provincetown, gave the following account of the Cramp fish, *Torpedo occidentalis* Storer.

This very remarkable fish was quite plenty at Provincetown, Cape Cod, some fifty years ago. From the 20th of September, and during October, November, and early December, they would run on shore during the night and would be left dry on the sandy beach by the receding tide. They were not seen at any other time of the year, and probably remain in deep water during the rest of the year. I have not known of their having been seen south of Gay Head, Martha's Vineyard, or north of Minot's Ledge (Cohasset). I know of

no other fish that seems to be confined within such narrow limits. It is probable that they are along our outer fishing grounds and are not seen by the fishermen, as they seldom bite at the hook. I have seen but one specimen taken with a hook, and have heard of only three others, during the past fifty years, having been taken in that way. They belong to the same great group of fishes which includes the Rays and Skates, and, like most of the group, the Torpedoes swim near the bottom and consequently would not be seen. When I was a boy, fifty years since, and for many years after, Torpedoes were very common along our shores; and during Autumn I visited the beach daily on Long Point (Provincetown) for the purpose of obtaining their livers, which yielded a large quantity of excellent oil, that was used for burning and which gave a better light than any other that I have seen, refined sperm oil not excepted. I have heard it said that the oil was an excellent remedy for cases of cramp by bathing the part affected. I have never had any experience in its use for that purpose, and, consequently, can say nothing of its medicinal properties. This fish varies from twenty to two hundred pounds in weight as they come from the water, the smallest yielding about one pint of oil, and the largest some three gallons. The shape of the liver is unlike that in any other fish. It is formed in two parts, equal in size and shape, located on each side. Torpedoes possess strong electric powers. I have received very severe shocks from them many times, and even after they had been out of water for some six hours, on touching them with the finger, I have been so shocked as to be thrown down upon the ground, or in the water. I have seen them passing along near the shore during the day and have thrown a harpoon into them and hauled them on shore. On taking hold of the harpoon, some six feet from the fish, my hand would soon become numb, and the fingers would incline to straighten so much as to make it difficult to grasp the pole of the harpoon. During the past twenty years these fishes have almost disappeared; some three or four specimens only having been found, each Autumn, for several years past; and I have found it difficult to procure more than one or two specimens, each year, when I needed them. Some forty or fifty years since they might have been obtained by hundreds.

Mr. Putnam followed Capt. Atwood and gave a brief account of the anatomy of the Torpedo, pointing out the position and structure of the electric battery.

Donations to the Museum and Library were announced.

Nathan Mortimer Hawkes, of Lynn, and Nathaniel B. Harris, of Salem, were elected Resident Members.

MONDAY, APRIL 16, 1866. Regular Meeting.

Vice President GOODELL in the Chair.

Letters were read from Prof. A. E. Verrill, Yale College; Rev. A. B. Keedig, Marshalltown, Iowa; E. Hall, Athens, Ill.; Dr. E. W. Hubbard, Tottenville, Staten Island; Rev. E. C. Bolles, Portland, Me.; G. K. Gilbert,

Rochester, N. Y.; E. S. Morse, Portland, Me.; Alpheus Hyatt, Baltimore, Md.; Dr. G. A. Lathrop, Petrolia, C. W.; Henry D. Aligny, Agent St. Mary's Canal, Michigan Co., Houghton, L. S.; Dr. A. S. Packard, Boston Soc. Nat. History; Br't. Lieut. Col. H. E. Maynadier, U. S. A., Fort Laramie, Dakota T.; Dr. Wm. Wood, East Windsor Hill, Ct.; Prof. Theo. Gill, Smithsonian Institution; T. A. Conrad, Philadelphia, Pa.; Prof. S. F. Baird, Smithsonian Institution; Chas. D. Marshall, Cor. Sect. Buffalo Soc. Nat. Sciences; C. M. Tracy, Lynn; Rev. Thos. Morong, Gloucester, Mass.; Royal Society, London; J. E. Hilgard, Asst. U. S. Coast Survey; Dr. M. M. Bagge, Utica, N. Y.; Mrs. P. A. Hanaford, Reading; Henry A. Smith, Cleveland, Ohio; Andrew Lackey, Marblehead; Trustees of Salem Athenæum; C. C. Jewett, Boston Public Library; Maine Historical Society; F. B. Meek, Spring, field, Ill.; Prof. G. C. Swallow, Columbia, Mo.; Prof. Henry James Clark-Cambridge, Mass.

The Secretary made the following statement.

In the month of August, 1859, the Institute received a communication, from the "Exploring Circle" of Lynn, calling attention to the discovery by them, of a very remarkable erratic rock in Lynn Woods, the peculiar character and position of which rendered it exceedingly interesting to science, while it was very liable to injury from mischievous hands. The coöperation of the Institute was therefore solicited in the effort to give some adequate protection to a work of nature so full of curious interest. A committee of consultation was accordingly appointed; but various circumstances conspired to hinder the accomplishment of any thing for a long time. Recently, however, the subject appearing to deserve a full examination, arrangements with the Exploring Circle were entered into anew, and on Saturday, April 7th, Messrs. H. Wheatland, F. W. Putnam, Caleb Cook and Benjamin Pickman, met by appointment, Messrs. J. M. Rowell, C. M. Tracy and J. C. Moulton, committee of the Circle, and proceeded to examine the rock in question. It was found to be, indeed, an object of great singularity, and eminently worthy to enjoy the lively attention of those pursuing geological study, particularly that of the drift period, whose relics and monuments lie so thickly scattered around us. Among the multitude of boulders and erratics of all kinds and dimensions that spread over our hills and valleys, including the remarkable "Ship Rock," now the property of the Institute, we have never examined one that presented such curious and striking features as this; and it is highly advisable that all proper action should be taken by this Society at once, to secure "Phaeton Rock," as it has been named, for the property of the Essex Institute, and thus prevent its destruction, either by the hand of wantonness, or the more innocent, but equally injurious work of the quarryman. A paper upon the subject has been received by the Institute from C. M. Tracy.

Mr. Tracy's paper was read and referred for publication.

After some remarks by Mr. Putnam on the subject of boulders and the drift, the matter was referred to a committee, consisting of Messrs. C. M. Tracy, Benjamin Pickman and Henry Wheatland, to take such action on behalf of the Institute, as they may deem advisable.

Mr. James H. Emerton exhibited a series of preparations of the oak-leaf galls and remarked upon the insects by which they were formed, and others that inhabited the galls, mentioning several parasites on the former. He also exhibited Lepidopterous larvæ which he had found feeding on the pith of the galls.

Mr. Putnam exhibited a recent addition to the cabinets of a specimen of *Platurus fasciatus*, from the Bay of Bengal, and remarked on the group of Sea Snakes to which it belongs.

Donations to the Museum and Library were announced.

Aaron Perkins, John Janes, James Gedney King, Nathaniel G. Simonds and E. R. Perkins, all of Salem, were elected Resident Members. Hon. Marshal P. Wilder, of Dorchester; Samuel A. Green, M. D., of Boston; and W. H. Niles, of New Haven, were elected Corresponding Members.

TUESDAY, MAY 1, 1866. Social Meeting at Hamilton Hall.

Vice President GOODALL in the Chair.

The object of this meeting was to bring together all the microscopes which could be conveniently obtained, for the purpose of interesting the friends of the Institute in this department of Science; also to celebrate in an appropriate manner, the ancient festival of the first of May.

The meeting proved a decided success, over three hundred members and their friends being present, beside a number of invited guests, among whom were Prof. O. W. Holmes of Boston; Dr. A. A. Gould, Vice President of the Boston Society of Natural History, and Messrs. Bonvé, Wilder, Bicknell and Sanborn, of the same Society.

The Chairman said that members of the Institute and those present who had attended its meetings need not be informed, but those of our friends not members of the Institute who had honored us with their presence this evening, from abroad, might be interested to learn, that the objects of our society were two fold, historical and scientific; and that, as we were about to celebrate one of the most ancient gala-days of old England, it might be and undoubtedly was expected, by some present, that an historical account of the day and its observance would be given to-night; but, it would be remembered that two years ago an evening was principally devoted to this subject, and, therefore, as the field selected for this evening's discussion was wide enough and sufficiently interesting, it had been determined to devote the evening to a notice of the early wild-flowers of this region, and of the history and uses of the microscope, an instrument which had proved so useful to the botanist and had so largely increased our knowledge of the structure and growth of plants, as well as thrown light on all other branches of science. The Chairman then introduced Mr. C. M. Tracy, of Lynn, the Botanical Curator of the Institute, who said that being too late to express the delightful wish of a

"Happy New Year," and too early for that other, peculiar in its Yankee patriotism, the wish for a "Fourth of July," he would beg leave to substitute another, to him, at least, as choice as either. In behalf of the early wild flowers that adorned the table before him, in behalf of the fresh grass springing along the brookside, the awakening hearts of flowers yet to gladden all our woods and valleys, the budding wreath of every thicket, and the sprouting verdure of every tree that, by and by, should shade our summer walks—in the name of all these he would cordially wish those here assembled the very best of a "Merry May." He then proceeded to introduce the several early flowers before him, dwelling particularly on the *Erythronium* or Dog-tooth Violet, which is not quite a lily, though nearly such, and bears to us the promise of other and brighter lilies, pure as alabaster or gay in ruddy richness, that before long shall be a joy to the whole northern hemisphere. The Wood Anemone was also noticed, and the Vernal Saxifrage, humble and unpretending, a dweller among the rocks, with a heart to resist the fierceness of the winter cold, and a petal white as the snow that just now covered it. The Wild Columbine is here with its gracefully nodding blossom, all gold within and ruby without, and though the botanist has named it in remembrance of an eagle's bloody talons, its horn-shaped petals may better represent the mimic cornucopias that herald the burden of autumnal fruitage. The Spicewood is here, but its early bloom has partly faded and the representative twig is but very small. Doubtless it was not well informed of this gathering in its honor, or surely it would have done itself better justice. He passed it only a day or two ago, hung with its golden mantle in the thicket, but it whispered no such information. Forgive the shrub, on another occasion it will meet you more fairly.

These are the precursors of a bloom that is yet to open on us in garden, woodland and wayside. These are the earnest of the dominant spirit of life, that, quieted but not extinct under the wintry blasts, now spring up again to gladden all the landscape. Let us welcome them for their cheering assurance. Let us take heart from the promise brought by them, that the season of genial warmth and life shall yet return, and though we may not, as our ancestors, join the Maypole dance, with sport, and song, and holiday attire, let us not prize the less the greeting of the vernal blossoms, that hint through their quiet loveliness the profound relations and dependencies between man and the flowers of the field.

Prof. O. W. Holmes, of Boston, was next introduced, and after briefly pointing out the distinction between the simple and the compound microscope, and describing the method by which the imperfections of the latter have been remedied within the last forty years, he proceeded to speak of the more remarkable improvements it has received at the hands of American opticians and philosophers.

1. Enlargement of the angle of aperture. In 1852 Mr. Quekett said in his well known Treatise, quoting Mr. Andrew Ross, the most famous of

London makers of microscopes, that 135 was the largest angular pencil which could be passed through a microscopic object glass. But long before this an American optician had made a $\frac{1}{12}$ object glass having an angular aperture of 146° , the same glass which he now held in his hand. Since that time the same maker has made glasses with an angular aperture, thirty degrees and more, larger than this. Mr. Webb will shew you in connection with his beautiful binocular a glass having an angle of 178° , which, as he says, and as we should expect, is equal to the resolution of the most difficult tests.

This audacious American who carried the angle of aperture more than forty degrees beyond the limits of the possible (according to the highest English authority) was Mr. Charles Spencer of Canastota, a small town in the midst of half-burned stumps of the forest in the interior of the State of New York.

2. Next on the list of American inventions and improvements, comes the inverted microscope of Dr. J. Lawrence Smith, of Louisiana, a form of instrument universally approved and very widely adopted by chemists as particularly fitted for their investigations.

3. The binocular microscope of Professor Riddell, of New Orleans which, variously improved and modified, is now extensively employed both in England and on the continent as well as in this country.

4. Tolles' binocular eye-piece, which bids fair to supersede the double body heretofore used.

5. The objective mirror, if we may so call it, of Professor Hamilton Smith, which most of us know only by report as yet, but which promises to do for the highest powers what the "Lieberkuhn" does for the lower ones.

The best known American microscope makers are Mr. Spencer, the pioneer among them, whose inventive genius has stimulated the opticians of the old world to attempt feats which they considered impossible until he shewed they could be and had been done; Mr. Tolles, his worthy successor, whose glasses challenge competition with any in the world; Mr. Wales, not so long known among us, but making first rate objectives; Mr. Grünow, whose instruments of moderate cost are perhaps the best the American student can buy, and who can make excellent microscopes of costlier pattern when required; Mr. Zentmayer, whose stands are equal, if not superior in elegance and workmanship to the finest of European make.

Dr. Holmes next proceeded to speak of microscopic photography. He referred to the very remarkable photographs made by Dr. John Dean, of Boston, from his own sections of the spinal cord.

He then shewed some specimens of the art sent him a week or two since by Dr. Woodward, in charge of the medical department of the Army Museum at Washington. These micro-photographs made by Dr. Edward Curtis, are the most extraordinary in many respects Dr. Holmes had ever seen. The object chosen was the well known test *Pleurosigma angulatum*. Two nega-

tives were taken, one with a $\frac{1}{2}$ and amplifier made by Wales, the other with a $\frac{1}{80}$ of Powell and Lealand. Each of these gave an enlargement of more than two thousand diameters. An enlarged copy of these gave them over nineteen thousand diameters. The spots of the diatom thus magnified are $\frac{1}{2}$ of an inch in diameter, perfectly sharp in outline, circular in form, but appearing as if they were hexagonal when looked at from a distance.

Dr. Holmes then said that at the risk of taxing the powers of belief of those before him he would attempt to give some idea of what is meant by an enlargement of twenty thousand diameters, within a fraction of which these objects are amplified.

It means that their surface, or that portion of it which you see, looks four hundred million times as large as it really is.

If your thumb-nail were thus magnified it would cover eighteen acres of ground.

A fly, weighing one grain, thus magnified in surface and in like proportion in thickness so as to keep his proper figure, if his weight increased at the same rate as his bulk, would weigh as much as a million horses rolled into one great monster horse.

A man weighs a million grains, and magnified in each dimension, as much as these dots are enlarged, would weigh as much as a billion horses; more very probably than ever lived on this planet, from the Adam of horse-flesh to the present time.

Many who are here this evening remember the famous moon-boax of Richard Adams Locke. It seems not impossible that the fancy of enlarging telescopic images by the microscope so as to bring out details upon the surface of the satellite may yet be realized. If the moon looks about a foot in diameter, it would, if enlarged as these dots are enlarged, be extended to nearly four miles in diameter, say, if you will, $\frac{1}{600}$ of its actual diameter. This would give us pictures of everything on the scale of one inch to fifty feet, and would shew us men and women, if such there were on the moon's surface, as exceedingly interesting little animals of about the size of certain insects held in small esteem by the human species, and very easily seen as well as felt.

Errors excepted, of course, in the above calculations, which are believed, however, to be essentially correct.

Dr. Holmes then said that he had been particularly requested to bring with him the microscope which he is in the habit of using, the mechanical arrangements of which are of his own contrivance. The glasses shewn in connection with it were a $\frac{1}{2}$, a $\frac{1}{4}$ and a $\frac{1}{12}$ made by Spencer.

This instrument was shewn with the same test which had been exhibited in the photographs, but magnified in it to about one thousand diameters, shewing the dots by oblique illumination with the lamp and the small plano-convex lens occupying one opening of the diaphragm.

The principal points in the simple and inexpensive arrangement to which he called attention, were the following :

1. Fixed wooden stand, carrying with it lamp for direct illumination, objectives, eyeglasses and other apparatus.

2. Tube supported on two forks cut in the wood ; inclined at an angle of 35° ; rotated by turning the shade-disk, which is 8 inches in diameter, and thus regulating the focal distance by the movement of a brass check which bears against an inclined surface of glass, giving a rapid and medium adjustment.

3. Delicate secondary adjustment, by a screw with scalloped head, placed close to the thumb which with the forefinger moves the object stage. This screw depresses very slightly one of two brass plates, fixed to object stage, against which the glass object slide is pressed forward by two small springs. This arrangement has the incidental advantages of bringing all objects to the same level, and of affording protection to the thin glass of the slide.

4. Horse-shoe magnet for fixed stage.

5. Object stage of soft iron, 8 inches long, 1 inch and $\frac{1}{4}$ wide, adhering to fixed stage by attraction, assisted by brass spring at one end, loaded to keep it down, moves horizontally by sliding over an edge $\frac{1}{4}$ of an inch to the left of middle of fixed stage, and up and down in the arc of a circle of which this edge is the centre. Requires but one hand for management, which hand is always in position to command the fine adjustment.

6. Achromatic condenser (or any other piece of apparatus) slides in between the branches of the horse-shoe magnet. The diaphragm is directly behind the achromatic condenser.

7. A small plano-convex lens occupies one hole of the diaphragm and is very useful in concentrating the rays of oblique light when that is used.

8. Although this instrument is arranged chiefly with reference to using the direct rays of a lamp without any reflection, a mirror can be substituted for the lamp if desired. The following is Dr. Holmes's method of arranging this adjunct. A plano-convex lens is set in a frame, to be used as a condenser. Two plane mirrors of the same size are cemented back to back. This double mirror fits against the plane side of the lens, thus giving a plane mirror on one side and the equivalent of a concave mirror on the other.

9. Dr. Holmes employs a simple *indicator*, made by sticking a portion of a fine needle to the diaphragm of the eye-glass with a bit of wax. This is a great convenience in demonstrations, it being easy to bring any particular object of examination to the point of the needle by moving the stage.

10. A very convenient complement of the instrument here shewn, is the simple arrangement shewn by Quekett (fig. 257, 2d edition) which is especially adapted for very low powers, for dissecting, examining the circulation, etc.

Dr. Holmes said he would take occasion to mention a plan he had lately adopted, for preserving recent preparations of soft tissues so that they could be shewn day after day. It is simply laying them on a wet cloth, which is it

self placed on a sheet of india-rubber cloth, and covering them with a bell-glass. The air being soon saturated with moisture, the preparations cannot dry.

He then exhibited one of Mr. Lockhart Clarke's sections of the spinal cord, and a single nerve-cell isolated and stained with carmine, prepared by Gerlach, both of which were lent him by Dr. Dean, to whom they were presented by the distinguished anatomists of whose skill they are singularly perfect specimens.

At the conclusion of Prof. Holmes's remarks, the orchestra furnished music, the seats were removed from the hall, and an opportunity was given to all to examine the various microscopes and objects under them.

The objects were much varied in character. Dr. Holmes brought specimens of the *Pleurosigma angulatum*, besides the sections made by Lockhart Clarke and Gerlach mentioned above. Mr. Bicknell had several fine injected sections of bones and teeth prepared by himself, as well as a large collection of other objects, part of which he exhibited with a polarizer. Under Mr. Webb's Binocular the head of a mosquito proved so attractive that no time was found to exhibit but one or two other objects under his fine instrument. Dr. Wilder had specimens of the silk of the *Nephila plumipes*, and various parts of the spider. Mr. Sanborn exhibited a number of living animalculæ.

Under the other microscopes were series of the pollen, and sections of the leaf and stem of the Mayflower, Anemone, Bloodroot, Dogtooth Violet and several other early spring flowers; a large number of insects and parts of insects; *Trichina spiralis*; sections of spines of echinoderms; diatoms; &c., as well as several specimens of microscopical photography and engraving.

The following is nearly a complete list of the microscopes that were in the hall for use, arranged under the names of their owners.

PROF. O. W. HOLMES, of Boston. An instrument of his own construction, previously described.

E. BICKNELL, of Boston. A large and very fine American instrument made by Zentmayer, with Wales' objectives.

DR. B. G. WILDER, of Boston. A Smith and Beck's Student's instrument. (Dr. Dean's working instrument).

F. G. SANBORN, of Boston. The Mass. State Cabinet Nacet instrument, of English form of stand with a lever stage.

ESSEX INSTITUTE. A Prichard Standard microscope, formerly owned by Mr. Cole, and presented to the Institute several years since by Mrs. Cole. An English instrument made by Clarke, presented to the Institute by Francis Peabody, Esq.; also a French dissecting instrument made after Mr. Peabody's plan and presented by him to the Institute.

BENJAMIN WEBB, JR., of Salem. Smith and Beck's Binocular, Wenhams's invention; and a Ladd's instrument.

H. F. SHEPARD, of Salem. Nachet and son's microscope. Attached to this instrument was Nachet and son's "Chambre claire" or "Camera lucida." To this camera can be joined, either above or below the picture, as occasion requires, a piece of blue glass to assist in rendering the view of the pencil distinct.

DR. W. L. BOWDOIN, of Salem. An Oberhaeuser, modèle No. 2.

DR. G. A. PERKINS, of Salem, a Nachet, moyen modèle, and an antique instrument made by Adams, of London, and formerly owned by the late Dr. Treadwell, of Salem.

H. F. KING, of Salem. An Oberhaeuser, modèle No. 2. and a Grünow's Student's.

STATE NORMAL SCHOOL, Salem. A Grünow's Student's.

SALEM HIGH SCHOOL. A Mirand of English form.

DR. WM. MACK, of Salem. An Oberhaeuser petit modèle.

DR. HENRY WHEATLAND, of Salem. A Fraunhofer, simple model.

CALEB COOKE, of Salem. A Mirand, petit modèle, and a Raspail.

F. W. PUTNAM, of Salem. A simple English microscope, and a small Scholar's instrument of American make.

JAMES H. EMBERTON, of Salem. A Craig.

Several other small instruments of various kinds were also in the hall, making thirty microscopes in all, of twenty-five different patterns.

After about an hour had been passed by the company in examining the various objects, the Institute adjourned and a collation was partaken of, after which the large hall was given up to social enjoyment, and the instruments were removed to the smaller hall below, where the microscopists spent several hours very profitably. Prof. Holmes had here an opportunity of explaining the construction of his instrument more fully, and the fine nervous sections which he brought were much appreciated and examined. Mr. Bicknell was also able to show the capabilities of his fine instrument, and to explain the peculiarities of the stage movement, mirror adjustment, &c. Mr. Webb also exhibited, under his binocular, gold dust and the stellate hairs on the leaf of *Deutzia scabra* with fine stereoscopic effect. Considerable interest was also evinced in the comparison of Smith and Beck's fifth with that of Wales. The result was that no difference could be detected in the definition of the object used, the pygidium of a flea, though from Wales' fifth being of a larger angle it would undoubtedly have had the advantage on lined test objects.

MONDAY, MAY 7, 1866. Regular Meeting.

Vice President GOODELL in the Chair.

Letters were read from Prof. A. E. Verrill, Yale College; S. E. Wright, Cincinnati, Ohio; Prof. Francis S. Holmes, Charleston, S. C.; E. S. Morse, Portland, Me.; C. W. Bennett, Holyoke Mass.; J. A. Allen, Springfield,

Mass.; Miss L. E. Walker, Worcester Society of Natural History; J. F. Richardson, Portland, Me.; R. E. C. Stearns, San Francisco, Cal.; Dr. Wm. Wood, East Windsor Hill, Ct.; Dr. B. G. Wilder, Boston; J. A. Huntington, Oberlin, Ohio; Prof. G. C. Swallow, Columbia, Mo.; O. C. Marsh, New Haven, Ct.; Robert Howell, Nichols, N. Y.; E. Suffert, Havana, Cuba; G. F. Matthew, St. John, N. B.; Maj. R. S. Williamson, U. S. Engineers, San Francisco, Cal.; W. H. Edwards, Newburgh, N. Y.; Boston Public Library; Massachusetts Historical Society; M. Fenollosa, Salem; R. R. Endicott, Beverly; F. S. Pease, Albany, N. Y.; Stephen H. Phillips, Salem; Geo. E. Brackett, Belfast, Me.; E. W. Treadwell, Boston; Hon. Marshall P. Wilder, Dorchester; Capt. N. E. Atwood, Provincetown; N. G. Simonds, Salem; S. C. Bancroft, Salem; Prof. O. W. Holmes, Boston; Dr. Samuel A. Green, Boston; C. M. Tracy, Lynn; Leverett Saltonstall, Newton; Henry Saltonstall, Boston; D. Choate, Essex; Newburyport Public Library; Dr. James R. Nichols, Haverhill; C. P. Preston, Danvers.

Mr. W. P. Upham read extracts from the Records of the Essex County Quarterly Court, in relation to the suit of John Pickering vs. Walter Price, and Samuel Gardner for injury to the land of the plaintiff, in consequence of building a mill, in 1662, called "New Mills," (now know as the "City Mills" and formerly as "Maloon Mills," &c.). Several depositions were also read.

A discussion followed on this and kindred subjects by Messrs. Goodell, Upham, Ropes and others, and on motion of Mr. Kimball, a copy of the papers read by Mr. Upham were requested for publication in the Historical Collections.

Donations to the Library and Museum were announced.

The Superintendent on announcing the donations to the Museum, spoke at length on the extent and great value of those received from Capt. W. H. A. Putnam and Capt. Joseph Hammond. The former consisted of a large collection of Corals and other Radiates, Fishes, Reptiles, Birds, Mammals, Crustaceans, Shells and Insects, from various parts of China and the East Indies; the latter principally of Corals, Echini, Fishes, Crustaceans, Mollusks and Lichens, from the Sandwich and Falkland Islands, and Medusæ and Crustaceans from the Gulf weed. These collections contain many species not before in the Museum and form the most valuable additions of the year.

The cast of the humerus of the *Mylodon* found in Oregon, in 1839, and described by Dr. H. C. Perkins, of Newburyport, was also announced as presented by the describer.

A valuable historical relic, consisting of the figure head of a native war vessel of the Kingsmills Islands, was also presented by Capt. Hammond.

The Superintendent exhibited two microscopes which had been presented by the President. One of them was an English instrument, made by Clarke, and the other a French Dissecting instrument made after the directions of the President.

On motion it was then *voted*; that Messrs. Rantoul, Putnam and Wheatland, be a committee to take into consideration the donations of the President, and Capts. Putnam and Hammond, and present such acknowledgments as may be deemed proper.

Mr. R. S. Rantoul, in behalf of the Committee on the Literary Exercises of the May-day Social Meeting, after appropriate remarks presented the following resolution:—

Resolved:— That the thanks of the Essex Institute be conveyed to Drs. Holmes and Wilder, and Messrs. Bicknell and Sanborn, of Boston, for the honor and pleasure conferred by their presence with us on the evening of the first of May, and for the interest manifested in the occasion, by their several contributions of instruments of rare value and power to the collection of microscopes then exhibited.

The Resolution was adopted unanimously, and it was then voted that copies of the same be sent to the several gentlemen therein named.

Messrs. Rantoul, Upham and Putnam were elected a committee to nominate officers for election, at the annual meeting, on Wednesday next.

Samuel Hutchinson, of Salem, was elected a Resident Member.

WEDNESDAY, MAY 9, 1866, Annual Meeting.

Vice President FOWLER in the Chair.

Records of the last Annual and Regular meetings were read.

The annual reports of several of the officers were read.

THE SECRETARY stated that the occurrence of the annual meeting calls upon the various officers and committees to review the doings of the year, and to present an abstract of the results of their operations.

The Society is in a good condition. The receipts from the assessments of Resident Members, the sale of publications, and all other sources were larger than during any previous year, yet, at the same time, the expenditures have been large in consequence of the increased activity of the Society and the high prices of all articles of consumption. A donation of one thousand dollars from a native of Salem, received in October last, was a most opportune contribution to the treasury.

Fifty Resident, and thirty-five Corresponding members have been elected during the year. Notice of the death of seven of the former and of four of the latter have been received. The present number of members is 696; consisting of 529 resident, and 167 corresponding.

Biographical notices of the following deceased associates will be prepared for the Historical Collections. James B. King, died at Salem, May 25, 1865. Charles F. Williams, died at Salem, June 4, 1865. Stillman Barden, died at Rockport, Aug. 7, 1865. Henry Cogswell, died at Salem, Dec. 12, 1865. Harriet C. Neal, died at Salem, Dec. 16, 1865. Henry S. Lufkin, died at Lynn, Jan'y, 1866. Nathaniel Brown, died at Salem, April 27, 1866. Isra-

el K. Tefft, died at Savannah, Ga., June 30, 1862. Joseph Willard, died at Boston, May 12, 1865. Henry W. Ducachet, died at Philadelphia, Dec. 13, 1865. Simeon Shurtleff, died at Simsbury, (Weatogue) Conn., Dec. 29, 1865.

Six Field Meetings have been held during the past season; at Nahant, Standley's Grove in Beverly, Reading, Georgetown, North Andover and Newburyport. These meetings have been largely attended with increased interest; everywhere the Institute has been very kindly received and every facility extended. Our thanks are especially due to the friends who have welcomed us in the various towns, and also to the Directors and Superintendents of the Eastern and the Boston and Maine Railroads for their ready coöperation in furnishing the necessary accommodations; particularly to the former, for extra trains, when desired, and other facilities in aid of the general objects. The quarterly and semi-monthly meetings have been held as usual at the rooms in Plummer Hall. A new feature has been added to the evening meetings under the form of a social gathering at Hamilton Hall, on the evening of May-day. Some thirty microscopes were placed upon the tables, with suitable preparations to illustrate the remarks made in the early part of the evening by C. M. Tracy, on the flowers of May, and Dr. O. W. Holmes, of Boston, on the history and the uses of the microscope for scientific research. After a collation the remainder of the evening was devoted to social recreation, thus happily blending instruction and amusement.

The Correspondence has largely increased during the year, in consequence of the more extended circulation of the different publications, the exchange of books, the receipt and presentation of numerous specimens. Seven hundred and eighty-nine letters have been received by those having charge of the several departments and placed on file.

The Publication of the Proceedings and Historical Collections has been continued during the year. In addition to the above, an Historical Notice of the Institute, with the Act of Incorporation, &c. was issued in April, and distributed to the members, subscribers to the publications, and exchanges.

The Annual Exhibition of Fruits, Flowers and Vegetables, took place at Mechanic Hall, on Wednesday, Thursday, Friday and Saturday, Sept. 13, 14, 15 and 16, 1865. The committee of arrangements were enabled to decorate the Hall by the kind and timely assistance of the ladies, members and friends, and they exerted themselves assiduously to sustain the exhibition, particularly at a season of drought of unprecedented extent, when vegetation suffered severely and many predicted that, in consequence thereof, the display would amount almost to a failure. Committees were appointed to prepare a schedule of premiums, which was printed and distributed, and prizes were awarded to the successful competitors in accordance therewith, whenever the specimens exhibited were worthy of such recognizance.

THE TREASURER presented the following statement of the financial condition for the year ending May, 1866.

GENERAL ACCOUNT.

Debits.

Athenaeum; Rent, half Fuel, Attendance, &c.....	\$617 66
Collecting Assessments, \$23 44; Gas, \$20 40.....	43 84
Publications, \$1550 84; Social Meeting, May 1, \$210 84.....	1761 68
Horticultural Exhibition, Sept., 1865.....	757 82
Tableaux, Nov., 1865.....	211 29
Express and Postage, \$151 83; Sundries, \$99 12.....	250 95
\$1000 U. S. Bonds 7-30.....	1005 70
To Historical Account.....	142 50
To Natural History and Horticultural Account.....	199 96
Balance in Treasury.....	62 48
	<hr/>
	\$5053 88

Credits.

Balance of last year's account.....	12 27
Dividends Webster Bank, \$50; Coupons U. S. Bonds, \$51 50...	101 50
Sale of Publications, \$1018 21; Assessments, \$952.....	1970 21
Horticultural Exhibition, Sept., 1865.....	785 75
Tableaux, Nov., 1865.....	412 02
May-day Meeting, \$247; Sundries, \$15 13.....	262 13
Donation from a native of Salem, \$1000; Sale U. S. Bond, \$510	1510 00
	<hr/>
	\$5053 88

NATURAL HISTORY AND HORTICULTURE.

Debits.

Preservatives and Taxidermy, \$111 86; Cases, \$83 89.....	\$195 75
Printing, \$23 12; Sundries, \$33 09.....	56 21
	<hr/>
	\$251 96

Credits.

Div. Lowell Bleachery, \$40 00; Div. Portland, Saco and Ports- mouth Railroad, \$12 00.....	52 00
General account.....	199 96
	<hr/>
	\$251 96

HISTORICAL ACCOUNT.

Debits.

Binding, \$195 00; Sundries, \$5 50.....	\$200 50
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Credits.

Div. Naumkeag Bank, \$20 00; Coupons Michigan Central R. R. Bond, \$38 00.....	58 00
General account.....	142 50
	<hr/>
	\$200 50

THE LIBRARIAN reported that the additions to the Library have been as follows;

Octavos and Lesser fold,.....	394
Quartos 8, Folios 4,.....	12
Newspapers, Folios,.....	52
Pamphlets and Serials,.....	1526
	<hr/>
	1984

The above have been obtained, with few exceptions, wholly by exchange, and by donations from 20 Editors, 50 Societies, and 148 Individuals.

The Library requires more accommodation for the proper arrangement of the books, papers, pamphlets, &c., in order to afford greater facility for reference. The same pressing wants have previously been presented to the attention of the Institute.

THE SUPERINTENDENT OF THE MUSEUM reported that it devolved upon him to present a brief account of what has been done during the past year as regards the Museum, and to call attention to its wants.

In no year has so much been done for the increase and arrangement of the Museum as the one which closes to day. During this period we have received about 16,000 specimens in the Natural History Department, from 175 different persons, and in 228 separate donations. Several of these donations have been very large and valuable, and have added much to the importance of the Museum to the scientific student. Attention is called to the more prominent of these, and reference to the printed quarterly lists is made for a notice of the others. In those lists will be found recorded many donations of valuable specimens.

To Capt. W. H. A. Putnam, the Institute is indebted for a large collection of Corals, from Singapore, consisting of nearly 400 specimens, representing about 75 species. Capt. Putnam has also brought to the Institute a fine collection of about 75 Bird Skins, from the Spice Islands, as well as a large number of Mammals, Birds, Reptiles, Fishes, Insects, Crustaceans, Mollusks, and Radiates, from various parts of the East Indies, China, China Sea, and several points on his passage home.

To Capt. Joseph Hammond, we are under obligations for several species of Corals not before in the collection, from the Sandwich Islands, and for a large collection of Shells, several rare Echinoderms, Fishes and Crustaceans, from the Falkland and Sandwich Islands, as well as a collection of the Lichens of the Falkland Islands, and several other specimens of great interest.

Dr. Benjamin Pickman has purchased the well known cabinet of Massachusetts Shells made by Mr. Joseph True, of this city, and presented it to the Institute. This is a most acceptable donation, as nearly all the species of our state shells are represented in the collection, which contains several of the greatest rarity, and it will take the place of the old collection of Mas-

sachusetts shells, which, from having been placed in cedar wood cases, was entirely ruined by a deposit of oil from the wood.

The Rev. E. C. Bolles, of Portland, has evinced his continued interest in the Society by sending us identified specimens of such species of Shells as he has received or collected from time to time.

Prof. J. G. Norwood, of the Missouri State University, has kindly forwarded a large collection, containing over 300 species, of identified Fossils, principally from Missouri, accompanied by a section, drawn with great care, which exhibits the position of the various strata from which they were obtained.

Prof. Richard Owen, of the Indiana State University, has also sent large and valuable collections of Western Fossils, Minerals, Shells and other specimens.

From Mr. E. Hall, of Athens, Ill., a collection of over 400 species of Rocky Mountain and Western Plants has been received, as well as quite a number of interesting, and to the Museum, new zoological specimens, and several Fossils.

By the Smithsonian Institution we have been remembered, and through the kindness of its officers we have received several very valuable collections of Shells, Fishes and Birds' Eggs.

The Chicago Academy of Sciences has presented a fine collection of Birds' eggs, and a number of Skins of Birds, of species not before in the Museum.

From the Buffalo Society of Natural Sciences, we have received a large collection of the Plants found in the vicinity of Buffalo.

To Dr. Daniel Clarke, of Flint, Mich., we are indebted for a collection of Shells, Insects, Fishes and Reptiles from Michigan.

Mr. Robert E. C. Stearns, of San Francisco has kindly sent several hundred species of shells from California, New Mexico and the Pacific coast of America.

We have received from Prof. A. E. Verrill, of Yale College, a valuable collection of Minerals, several Radiates, and a number of Insects, and we shall soon receive large additions to our collection of Corals and other Radiates from this gentleman, to whom we are already under great obligations for his identification of our Corals.

To George C. Huntington, Esq., of Kelley's Island, Lake Erie, we are indebted for a collection of the Fishes of the Lake, and for a number of Fossils from the Island.

To the President of the Institute the workers in the Museum are greatly indebted for a most valuable gift of two fine microscopes; one, a dissecting instrument made on a peculiar plan, from his directions while in Paris, and furnished with a set of Nachets' objectives; the other, an English Instrument made by Clarke, and provided with considerable apparatus and with a set of Nachets' acromatic objectives, as well as several simple lenses, two eye pieces camera, &c.

In pursuance of the plan which has been adopted for the distribution of our duplicate specimens to such persons and Institutions as will make good use of them for scientific purposes, the following collections have been sent out during the year.

To the CHICAGO ACADEMY OF SCIENCES, 19 species, 21 specimens of Corals from the East Indies, 2 species, 2 specimens of Corals from Zanzibar.

To the BOSTON SOCIETY OF NATURAL HISTORY, 8 species, 8 specimens of Corals from the East Indies, 2 species, 2 specimens of Corals from Zanzibar.

To the BUFFALO SOCIETY OF NATURAL SCIENCES, 9 species, 10 specimens of Corals from the East Indies, 1 species, 1 specimen of Coral from Zanzibar.

To PROF. J. G. NORWOOD, MISSOURI STATE UNIVERSITY, 12 species, 17 specimens of Corals from the East Indies, 2 species, 2 specimens of Corals from Zanzibar.

To PROF. RICHARD OWEN, INDIANA STATE UNIVERSITY, 11 species, 13 specimens of Corals from the East Indies, 2 species, 2 specimens of Corals from Zanzibar.

To DR. DANIEL CLARK, FLINT, MICH. SCIENTIFIC INSTITUTE, 8 species, 10 specimens of Corals from the East Indies.

To PROF. P. A. CHADBOURN, WILLIAMS COLLEGE, 8 species, 13 specimens of Corals from the East Indies, 1 species, 1 specimen of Coral from Zanzibar.

To G. A. BOARDMAN, MILLTOWN, ME., 8 species, 9 specimens of Corals from the East Indies, 1 species, 1 specimen of Coral from Zanzibar.

To E. L. LAYARD, SOUTH AFRICAN MUSEUM, CAPE TOWN, 95 species, of several specimens each, of North American Shells, and 2 species, several specimens, of Mass. Crustaceans.

To O. C. MARSH, YALE COLLEGE, 1 Ophiura from the Lias of England, 43 specimens, several species, of Shells from the Oriskany Sandstone, Md.

To W. W. DENSLOW, INWOOD, N. Y., 26 species of Plants from Zanzibar.

To THOMAS BARLOW, CANASTOTA, N. Y. 15 species, 15 specimens of Insects from various localities.

To CABINET OF YALE COLLEGE, PROF. VERRILL, 8 species, 8 specimens of Insects from China, 2 species, 2 specimens of Insects from Para, 1 species Lepidoptera from Essex Co., 22 species, 60 specimens of Neuroptera from Essex Co., 20 specimens of Branchiopus from Salem, 6 specimens of Asterias from Salem Harbor.

To ROBERT E. C. STEARNS, San Francisco, Cal. 160 species of North American and 44 species of Foreign Shells, of several specimens each.

The work of arrangement and identification of the specimens has been continued during the year, and much progress has been made in several departments. In this the superintendent has been much aided by the voluntary work of Mr. Caleb Cook who, since his return from Zanzibar, has devoted his whole time to the Institute, and done much towards the preparation of specimens and their arrangement, and has materially increased the good name of the Institute by his invaluable aid in separating duplicate specimens and preparing them for distribution.

To Dr. B. Pickman the superintendent is also much indebted for his voluntary labor and assistance.

Mr. James H. Emerton, the Curator of Articulata, has continued to devote a part of his time to the valuable and large collection under his charge, and has always been ready to aid in the general work of the Museum.

Attention is again called to the necessity of providing increased means, for the proper care and arrangement of the pinned Insects under the charge of this curator, who, with the most untiring zeal, will not be able to prevent the loss of a large number of specimens, during the coming year, unless something is done towards providing for their permanent arrangement.

The Ethnological section of the Historical Department has received many valuable donations from sixty-two persons. The Institute is much indebted to Mr. John Robinson, the curator in charge of this section, for his faithfulness, and it is to him entirely that its present good state of preservation and accurate arrangement is due; though, from the very limited space which is allotted to it, he is unable to fully carry out the details of his plan.

The Manuscripts have received the attention of Mr. W. P. Upham, but until further accommodations for them are provided this large and valuable part of the Historical Department can be of little use to the student of history. Attention is therefore especially called to the curator's report of this section.

More or less work has been done in all the departments of the Museum and its condition and arrangement has been much improved, and its value thereby greatly increased. Much labor is still required, however, in order to fully perfect the proposed arrangement of the whole Museum.

Prof. E. D. Cope, of Philadelphia, has agreed to furnish, for publication, a complete catalogue of the Reptiles, and the Batrachians and Saurians are now in his hands for identification.

Prof. H. Wood, Jr., of Philadelphia, has also kindly consented to identify the collection of Myriapodes and Centipedes, and the specimens have been sent to him for that purpose.

Prof. Theodore Gill, of the Smithsonian Institution, has borrowed and safely returned the small collection of skulls of Seals which are now labeled according to his identifications. He has also borrowed, for study, a skull, of the Tapir.

The collection of Cetacean skulls and bones have been loaned to Prof. Cope for his investigations, and have just been safely returned. Prof. Cope has found among the skulls types of three new species of this interesting group of mammals.

The collection of native Neuroptera has been studied by Mr. S. I. Smith, of Yale College, and has been returned with his identifications.

Our whole collection of Hymenoptera is now in the hands of Dr. A. S. Packard, Jr., of the Boston Society of Natural History, and of Mr. E. T. Cresson, Secretary of the Entomological Society of Philadelphia, for study and identification, and will be much enhanced in value by being labeled by these gentlemen. Dr. Packard is engaged in preparing a paper, which will be published in the Proceedings of the Institute, on the Larvæ of this most interesting order of insects, and he is much indebted to our collection for important material for his work.

Dr. Elliott Coues, U. S. A., has identified the collection of North American Birds, and is now preparing a catalogue of them for publication in the Proceedings of the Institute.

The various and increased duties of the Superintendent in the care of the Museum and the specimens which are daily received; the editorship of the Proceedings and the Naturalists' Directory; and the large amount of correspondence which devolves on him (527 letters having been written by him during the year, besides the mailing of several hundred circulars, the various numbers of the Proceedings, &c.), makes it now no longer possible for the Institute to continue its present activity without other regular assistants in the Museum, and increased means for the care and arrangement of the collection, now so grown that there is no longer room for it in the present cases; many thousand specimens being stored in boxes, drawers, cans and kegs, awaiting case room, jars and alcohol.

Under these circumstances, you will, therefore, permit the following, suggestions, for the further development of the Museum and its scientific work:—

1st. Several permanent assistants are required in the Natural History Department, who shall have charge of the several sub-departments.

2d. A small building, about thirty feet square, should be erected in the rear of the present building, and connected with it only by an iron door in the place of one of the end windows of the Museum Hall. This building should contain a room for the sole use of the persons in charge of the Museum and such students as might come to the Institute, with proper arrangements in the basement for the preparation of skeletons, &c., and, in connection with its heating apparatus, a small still for the redistillation of the old alcohol.

3d. As many cases as possible should be put into the present hall, which will allow of table cases, about eight feet by four, between the upright cases, making twelve cases of this size; a railing case on the gallery for the

accommodation of the insects; a few small cases under the windows, and one or two more central cases. This amount of case room, in addition to the present accommodations, would provide for the exhibition of the collections of Natural History for a few years to come; but in order to obtain room enough for the whole of the rapidly increasing museum and library a building occupying the whole of the land in the rear of Plummer Hall would be necessary. In this connection, attention is also directed to the present very small and insufficient accommodations for the meetings of the Society.

Such propositions as these may seem as far too vast for the Institute to undertake to carry out; but when the great interest manifested in the Institute, both at home and abroad, and its widely acknowledged activity and Scientific standing, is taken into consideration, it must convince the most skeptical that our Museum and Library have arrived at that condition when they can no longer be regarded as of local importance alone; and the large correspondence, and the widely spread distribution of our Publications, is a conclusive argument of the estimation in which the Institute is held, and of its great influence. Applications have also been received from young men, who wish to pursue Natural History as a professional study, for positions as students in the Institute, and as soon as proper accommodations and competent instructors are provided, the direct educational work of the Institute would be largely increased.

Must another year pass without some decisive action being taken to bring about the much desired and honorable position which we wish to maintain?

Mr. Cooke, the CURATOR OF RADIATA, reported that the collections under his charge are in good condition, and have increased to such an extent as to outgrow the present limited accommodation. The Echinoderms and Star fishes in particular are so crowded as to make it impossible to properly arrange them. In many instances it has been necessary to place specimens of different genera in the same bottle. Could the whole of the centre case in which they are now placed be given up to them there would be no more room than is required.

Another great drawback, in the arrangement of the alcoholic specimens of this department, is the want of jars for the Echinoderms and Star fishes, which, to a certain extent, require to be made especially for this purpose, and of works of reference for the identification of the specimens. This last, however, is being gradually overcome, and could some means be found for obtaining the requisite bottles, much could be done towards the final arrangement of the collection. The two large cases occupied by the Corals and Sponges are now much crowded, and great difficulty will be found to incorporate the large collections recently received.

A catalogue has been in progress for some time, and it is hoped that during the present year it will be ready for publication.

The additions to this department, during the past year, are of great importance. 520 specimens, containing 143 species, have been received from 14 donors, as follows: Henry F. Shepard, Col. Albert Ordway, Caleb Cooke, Edward L. Larrabee, Benj. Webb, Miss Eunice Congdon, Rev. H. W. Foote, J. H. Emerton, C. F. Nichols, Capt. E. Haskell, Capt. W. H. A. Putnam, and Capt. Joseph Hammond. The two last named donations are very valuable. That of Capt. Putnam, from the East Indies, contains 478 specimens, representing 83 species, of which 73 species, embracing 400 specimens, are Corals, many of which are new to the collection. Capt. Hammond's collection, though not so large, contains 43 specimens, exhibiting 15 species, from the Sandwich Islands, Kingsmills Group, and the Atlantic Ocean, all of which, with one or two exceptions, are new to the museum. During the past year a large number of specimens have been sent, as donations, to several societies and individuals.

The Curator begs to impress upon the members that much is still to be done in collecting specimens from our own shores, and requests their coöperation in the work. No matter how many or how common the specimens may be, they will all be used to good advantage, either in our own collection or in supplying the deficiencies in others.

Mr. Emerton, CURATOR OF ARTICULATA, reported that the specimens which were in the collection last year, remain, with few exceptions, as they were at the time of the last report. It is impossible to make any better arrangements for the exhibition of the specimens until our accommodations and pecuniary means are much increased.

As new specimens come in, more care is being taken in labelling and preserving them, so that the collection is gradually improving in usefulness, as well as in size.

The collection of cocoons and nests of insects has increased greatly during the last year, and when cases are obtained for their proper exhibition, they will make an interesting addition to the cabinet.

A large number of the moths have recently been named by Mr. F. G. Sanborn, of Boston, without removing them from the building. The native Neuroptera, sent to Mr. S. I. Smith, of Yale College, last winter, were recently returned, with several additions to their number, and labelled with their systematic names. The collection of Hymenoptera is now in the hands of E. T. Cresson, Secretary of the Philadelphia Entomological Society; and Dr. A. S. Packard, Jr., of Boston. Dr. Wood, of Philadelphia, has the Centipedes and Scorpions for identification.

Particular attention has been paid to collecting the Spiders of Essex County, of which about 150 species are now preserved in alcohol. Every effort will be made to make a speciality of this group of insects, and specimens from any locality will be most welcome.

Nearly 4000 specimens of *Articulata*, of which about one half are alcoholic, have been received during the year, from 54 persons and collections, nearly as follows: *Hymenoptera* 343, *Lepidoptera* 219, *Diptera* 250, *Coleoptera* 913, *Orthoptera* 30, *Hemiptera* 75, *Neuroptera* 50, *Spiders* 1000, *Myriapodes* 50, *Crustaceans* 800, *Worms* 100.

Mr. Robinson, *ETHNOLOGICAL CURATOR*, reported that, since the last annual meeting, the *Ethnological Department* has been added to by sixty-three donors, who gave upwards of one hundred donations, many comprising several articles. Of these, forty are War-relics; twelve are Ancient articles; seven persons gave thirty Indian relics, among these are several specimens exhumed at Salem Neck, the most curious being a pot made of soap stone which was found in a grave with several arrow-heads and other articles.

The number of Postage Stamps has been increased from eighty to one hundred and seventy-five, and they are now placed upon white paper in one of the small end cases.

During the year, one hundred and twenty-five specimens of Confederate paper currency have been presented, besides several specimens of Continental currency. Both the Confederate and Continental currency is to be placed, at some future day, in books of a suitable nature for their exhibition. The best and more curious specimens, however, have been arranged in the small end cases where they may be seen by all visitors.

Thus it will be seen that, although only one hundred donations have been noticed, there has been an actual receipt of four hundred and fifty articles.

During the year the room has been cleaned and all the cases have been kept almost entirely free from moths.

The South-Pacific war implements have been rearranged, and the South American implements placed beside them, thereby greatly adding to the good appearance of the room. The two models of native boats have been swung across the room, leaving considerable space on the top of the case that they occupied for other articles. The large table in the centre of the room has been covered with the war relics which were too large to be placed in the cases.

The collection is in good order, and, as far as room will permit, is arranged in a proper manner.

In the last report it was mentioned that the collection was much crowded, and the accession of four hundred articles, many of them large, makes it still more so; yet we shall endeavor to find room for all articles our kind friends are willing to send.

The book in which visitors are requested to record their names is kept in the Historical room, and it is estimated from the number of names entered in the book, and from the fact that but a small proportion of the visitors leave their names, that from seven to eight thousand persons have been benefited by the freedom of the rooms during the year.

The COMMITTEE ON MANUSCRIPTS would respectfully submit the following Annual Report :—

The collection of manuscripts is now very large and valuable, consisting of original Charters, Commissions, Account books, Court papers, Foreign papers and manuscripts, Almanacs with written notes, &c., besides considerable printed matter, which comes more appropriately under the charge of this committee than to any other now established, and which consists of rare historical tracts, maps, engravings, photographs, &c. These are now deposited in various places, many being arranged in drawers in the Historical room and the ante-room to the library, while others are stored in the attic.

The collection is rapidly increasing in size and importance, but, with our present limited accommodations, there is no room or place suitable for even the safe keeping of that already accumulated, and it is impossible to have the collection so disposed as to be of practical use. This is much to be regretted, for there are many very valuable documents both for antiquarian curiosity and for historical research, especially with regard to the history and biography of this vicinity.

If these papers, some of them coming down from the earliest Colonial times, and many furnishing details and items of information relating to individuals, public institutions, &c., which may become of the greatest importance to the future antiquarian, could be placed where they could be easily referred to, and at the same time be safe from fire, a great advantage would be derived from this department of the Institute, which, we regret to say, is now impossible.

The committee, therefore, earnestly recommend that some method be devised to accomplish this desirable object, and that a fire-proof addition to the present building be erected for the deposit of valuable historical relics, and they are further able to state, that, should such an addition be made, they have the assurance that a large number of valuable portraits and family relics, as well as many extremely valuable manuscripts, would be made over to the Institute, and they trust that the matter will receive the serious consideration of the Society.

WM. P. UPHAM,
For the Committee.

The PUBLICATION COMMITTEE submit the following annual report :—

They are happy in being able to state that the success of the published Proceedings of the Institute, for the last year, has been most encouraging. In their last annual report this committee referred to the fact that the Messrs. Trebner & Co., of London, in their letter of the 27 Jan. 1865, had expressed a desire to act as agents of the Institute, for the circulation of the Proceedings in Europe, and had requested that the title page should bear their imprint, in connection with those of Messrs. Westermann & Co., and Wm. Wood & Co., of New York. Since that date arrangements have been made through the

Smithsonian Institution, for the exchange of the Proceedings with 170 Foreign Scientific Societies, from which we have every reason to expect very valuable returns during the ensuing year. Besides these we are already in regular exchange with 35 Societies and Publishers of Journals in the United States and the British Provinces in North America.

It is extremely desirable that these exchanges be kept up and extended as far as possible to other Societies. Not only do such exchanges result in filling our scientific library with the latest publications, containing the most recent and valuable discoveries and suggestions in science, but they serve at the same time to bring the Institute into favorable notice with scientific men, everywhere, and so draw to our cabinet a larger collection of specimens; and they also diffuse more widely the results of the labors of our own naturalists and thereby add to the general stock of scientific knowledge.

Your Committee recommend that every effort be made by the friends and members of the Institute to aid the Superintendent and Editor of the Proceedings, in continuing, punctually, the issue of future numbers, and in enlarging, if necessary, the edition printed. Great aid can be rendered to this end by soliciting subscriptions to the work, which already numbers upon its list of paying subscribers probably as many names as are to be found upon the subscription list to the publications of any other scientific society in the country, and letters which have recently been received from scientific men in Europe, and the request from the Royal Society of London, to exchange its publications for ours, show that our work is becoming known and appreciated abroad.

The Naturalists' Directory has been received by scientific men with marked approbation, and has been most cordially supported and encouraged. The editor has informed us that several hundred names of foreign naturalists have already been received, and that as soon as the second part, now in course of publication, is printed, the third part, containing the foreign naturalists, will be ready for the press. The thoroughness of the work, which is necessary in order to make it perfectly trustworthy, involves the editor in an extraordinary amount of labor in its preparation for the press.

The following analysis of the list of subscribers to the Proceedings and Naturalists' Directory shows how widely these works are scattered, and from the almost daily receipt of new subscribers, it is more than probable that the number will be doubled during the publication of the coming volume of 1866 and '7.

Subscribers in Massachusetts, 102; New York, 39; Pennsylvania, 20; Ohio, 12; Connecticut, 9; Illinois, 7; Canada, 6; Maine, 5; New Jersey, 5; Michigan, 5; California, 5; Missouri, 5; Iowa, 4; Indiana, 4; Washington, 4; Maryland, 3; New Hampshire, 3; Vermont, 2; Kansas, 2; Florida, 2; Cuba, 2; England, 2; Nova Scotia, 1; New Brunswick, 1; St. Thomas, 1; Belgium, 1; Germany, 1; Wisconsin, 1; Kentucky, 1; Tennessee, 1; Virginia, 1; South Carolina, 1; Total, 258.

Your Committee are obliged to express regrets that the Historical Collections have not made so much progress during the past year as was hoped. The October and December numbers of last year have not yet been published, though they have been for a long time going through the press. It has been deemed advisable to continue this publication in quarterly instead of bi-monthly numbers, as heretofore.

It is believed that an effort to enlarge the number of subscribers to this periodical would be attended with success, if pushed forward with the assiduity exhibited in the case of our Proceedings. The number of subscribers to the Collections is now 112, which is 38 or 40 less than the number of subscribers with which the work began, and yet it has annually increased in importance to the historian and genealogist.

The Committee earnestly recommend the members of the Institute to use their influence to obtain new subscribers to this publication, which has, wherever it has fallen among students of our New England History and Genealogy, been received with high encomiums as a work of great value and interest.

A change of editors has already been arranged for the ensuing year; and it has been further resolved to call upon several members of the Institute to furnish regularly a certain number of pages for each number, which will ensure a more regular supply of copy for the editor, who, in preparing and arranging his material for the printer, would find it a great assistance to know some time beforehand, with sufficient certainty, precisely what and how much material his forthcoming numbers will contain, and also enable him to communicate with contributors respecting any obscure language or irregular arrangement in the manuscript, before the printer begins to call for copy.

Respectfully submitted,

For the Committee,

A. C. GOODBELL, JR.,

Chairman.

After the reading of the several reports, on motion of Mr. Kimball they were referred to a special committee, to consider upon the suggestions therein contained and prepare a condensed statement of the condition, doings and wants of the Institute, and to present the same to the friends of the Institution with a view of obtaining such material aid as will enable it to fully develop its plans in furtherance of the objects of its organisation.

Messrs. Rantoul, Brooks, Wheatland, Upham and Pickman were appointed a committee on nomination.

The Committee retired and then reported the following names to the meeting: Messrs. Francis Peabody, Charles A. ropes, R. C. Manning, Wm. Sutton, F. W. Putnam and S. P. Fowler, and they were duly elected as the committee.

On motion of Mr. Kimball it was also voted: that this committee be authorized to fill vacancies and to add to their number.

The following Officers and Committees were elected for the ensuing year, and until others shall be chosen in their stead:—

PRESIDENT,
FRANCIS PEABODY.

VICE PRESIDENTS,
Of Natural History—S. P. FOWLER. *Of History*—A. C. GOODELL, JR.
Of Horticulture—J. F. ALLEN.

SECRETARY AND TREASURER,
HENRY WHEATLAND.

LIBRARIAN,
CHARLES DAVIS.

SUPERINTENDENT OF THE MUSEUM,
F. W. PUTNAM.

FINANCE COMMITTEE,
J. C. Lee, R. S. Rogers, H. M. Brooks, G. D. Phippen, J. Chamberlain.

LIBRARY COMMITTEE,
J. G. Waters, Alpheus Crosby, H. J. Cross, G. D. Wildes, Wm. Sutton.

PUBLICATION COMMITTEE,
A. C. Goodell, Jr., G. D. Phippen, Benj. Pickman, C. M. Tracy,
Wm. P. Upham, R. S. Rantoul, F. W. Putnam.

LECTURE COMMITTEE,
Francis Peabody, A. C. Goodell, Jr., G. D. Phippen, George Parkins,
James Kimball, G. W. Briggs, F. W. Putnam.

FIELD MEETING COMMITTEE,
Francis Peabody, G. B. Loring, C. M. Tracy, S. P. Fowler, J. M. Ives,
G. D. Wildes, E. N. Walton, Charles Davis.

CURATORS OF NATURAL HISTORY DEPARTMENT.

Geology—H. F. Shepard. *Mineralogy*—C. H. Higbee and D. M. Balch. *Paleontology*—H. F. King. *Botany*—C. M. Tracy and T. L. Perkins. *Comparative Anatomy*—Henry Wheatland. *Radiata*—Caleb Cooke. *Mollusca*—H. F. King. *Articulata*—J. H. Emerton and Caleb Cooke. *Vertebrata*—F. W. Putnam. *Microscopy*—H. F. King, Benj. Webb, Jr., H. F. Shepard, Caleb Cooke, J. H. Emerton.

CURATORS OF HISTORICAL DEPARTMENT.

Ethnology—William S. Messervy, Matthew A. Stickney, John Robinson. *Manuscripts*—W. P. Upham, H. M. Brooks, S. B. Buttrick, G. L. Streeter, G. D. Wildes, E. S. Waters. *Fine Arts*—Francis Peabody, J. G. Waters, J. A. Gillis, Benj. Pickman.

CURATORS OF HORTICULTURAL DEPARTMENT.

Fruits and Vegetables—J. M. Ives, J. S. Cabot, R. S. Rogers, John Bertram, G. B. Loring, S. A. Merrill, W. Maloon, A. Lackey, G. F. Brown, C. H. Norris, C. H. Higbee, Wm. D. Northend. *Flowers*—Francis Putnam, Wm. Mack, Benj. A. West, Geo. D. Glover.

Mr. Upham read the following proposed amendment to the constitution, which will have to be submitted at two quarterly meetings before final action upon it can be taken.

Proposed amendment to Article III of the Constitution.

The following to be added to the fourth paragraph:—

“Provided that any Corresponding Member, at his or her request, and upon the recommendation of the Directors in writing, may, by vote at any meeting, become entitled to the privileges and liable to the duties and regulations of a Resident Member.”

It was then voted:—that the Curators of Horticulture be authorized to hold exhibitions of Fruits, Flowers and Vegetables, at such times and places as may be deemed advisable, and to adopt such regulations as may be requisite for the proper conducting of the same.

Letters were read from Dr. Wm. A. Nason, Chicago, Ill.; Prof. S. F. Baird, Smithsonian Institution; Rev. E. C. Bolles, Portland, Me.; Alpheus Hyatt, Baltimore, Md.

Luther D. Shepard and Samuel P. Walcott, of Salem, and Joseph W. LeFavour, of Beverly, were elected Resident Members.

MONDAY, JUNE 4, 1866. Regular Meeting.

Vice President GOODELL in the Chair.

Elliott Cones, Asst. Surg. U. S. A.; Sarah Ann Chever, of Melrose, Mass.; Burt G. Wilder, M. D., of Boston, Mass.; Thomas D. Lovett, of Malden, Mass.; Prof. Oliver Wendell Holmes, of Boston, Mass., were elected Corresponding Members.

Caleb A. Smith, of Salem, was elected a Resident Member.

THURSDAY, JUNE 7, 1866, Field Meeting at Haverhill.

The first Field Meeting of the season took place this day, several hundred persons attending, of which about two hundred left Salem at 8 o'clock, A. M., in an extra train over the Essex Road, passing through South Danvers, Danvers, Topsfield, Boxford, Georgetown and Groveland to Bradford station, near the bridge over the Merrimac, and proceeded to the Town Hall in Haverhill, where they were welcomed by Dr. James R. Nichols, upon whose invitation Haverhill had been selected as the place of meeting.

A small party of zoölogists left the cars at Groveland station, and made an excursion down the Merrimac to the ferry, where they crossed the river and continued their explorations through the fields and woods to Lake Kenosha, the head quarters of the meeting. This party passed several fishing stations and witnessed the capture of a few Shad, Alewives, Suckers and Lampreys, and they also secured several insects and other specimens found along their route.

The thriving and prosperous town of Haverhill has changed much within the last twenty years. The old ship-yards that were once located above the bridge, whither several of the time honored merchants of Salem were wont to repair to have their vessels built, have now disappeared, and in their stead are erected large blocks of brick buildings, from which, for the most part, issued the busy hum of shoe manufacturing and other trades, carried on in this hive of industry. Under the guidance of Hon. Alfred Kittredge, some of the party were favored with an opportunity of visiting two or three of the principal of these manufactories.

Haverhill, like all our old settlements, abounds in interesting historic lore. For about seventy years it was one of the most exposed of the frontier towns, and many a harrowing tale of Indian barbarity is among its well authenticated legends. We need only mention the names of Rolfe and Duston to suggest scenes of martyrdom and heroism not surpassed in any annals. And yet, for a place so rich in precious memories, the relics of the past have not been cherished with the care that they deserved, and the visible and tangible memorials are fewer than they should be, too many of them having been suffered to perish. George W. Chase, Esq., however, in his valuable history of Haverhill, has done much to perpetuate the remembrance of them, and has added to our literature one of the most interesting of town histories.

From the top of the Town Hall and the residence of Dr. Nichols, very commanding views of Haverhill and vicinity are enjoyed, including the valley of the Merrimac in one of its loveliest sweeps, the surrounding territory, and old Wachusett looming up in the dim distance.

After a short tarry at the Hall and flying visits to places in its immediate vicinity, vehicles were ready to convey the company to the beautiful grove on the estate of Dr. Nichols, bordering on the shores of Kenoza Lake, about a mile and a quarter from the main settlement. This lovely sheet of water, embosomed among the hills, covers an area of about three hundred acres. It was formerly known by the prosaic yet significant epithet of "Great Pond," and was always celebrated for the beauty of the surrounding scenery and the fine fish from its waters. The point of land on the northeastern extremity has for many years been a favorite place of resort for summer parties, and the citizens have a perpetual right to use it for this purpose. In 1859 the spot was improved and beautified, and the Lake formally renamed with appropriate dedicatory services. To the poet Whittier, a native of Haverhill, was entrusted the honor of selecting a name, and he christened the Pond "Kenoza Lake," "Kenoza" being the Indian designation of "pickerel," the species of fish most abounding in its waters. Whittier wrote a beautiful poem for the occasion, in which he charmingly sings the praises of the Lake.

During the forenoon the company improved the opportunity for rambling as their several tastes dictated, and at one o'clock reassembled on the

shore of the Lake, in the fine grove, where well spread tables and rustic seats on the sloping hill side were arranged, and a bountiful collation was prepared. At 2 P. M. the meeting was called to order with

Vice President GOODELL in the Chair.

The Chairman stated in brief the objects of the organization, and its growth in membership, which has now reached to the number of 530 Resident members, and alluded to its Library, its publications, and its extensive correspondence and system of exchanges with similar institutions in this and foreign countries.

The following letters were announced:—from Henry A. Smith, Cleveland, Ohio; William A. Williams, Salem; W. H. Niles, New Haven, Conn.; A. C. Goodell, Jr., Salem (received May 9); A. M. Edwards, New York, (May 10); Prof. E. D. Cope, Haverford College, Pa.; John R. Bartlett, Secretary of State, Providence, R. I. (May 11); Prof. F. V. Hayden, University of Pennsylvania; W. H. Pease, Honolulu, Sandwich Isles; Prof. A. E. Verrill, Yale College; J. Smith Futher, Westchester, Pa. (May 12); J. A. Allen, Springfield; J. K. Wiggan, Boston (May 14); New Orleans Academy of Science; G. W. Pease, Salem; T. H. O. P. Burnham, Boston (May 15); Henry d'Aligny, Houghton, Mich.; E. S. Morse, Portland Society of Natural History; F. Poole, South Danvers (May 16); Prof. S. F. Baird, Smithsonian Institution; J. Carson Brevoort, Brooklyn, N. Y. (May 18); Brevet Major Gen. C. S. N. Crawford, U. S. A. (May 19); G. A. Boardman, Milltown, Me.; Prof. Jeffries Wyman, Cambridge; Prof. Francis S. Holmes, College of Charleston, S. C.; Prof. A. E. Verrill, Yale College; Ass't Surg. Elliott Coues, U. S. A. (May 22); Otto Kuntz, Boston; Smithsonian Institution (May 23); Prof. S. F. Baird, Smithsonian Institution; W. Merritt, Sup't Boston & Me. R. R. (May 24); S. H. Scudder, Annaberg, Saxony; Prof. A. E. Verrill, Yale College; A. S. Taylor, Santa Barbara, Cal. (May 25); E. T. Cox, New Harmony, Ind.; G. D. Phippen, Salem; Dr. James R. Nichols, Haverhill (May 26); Otto Kuntz, Boston, (May 27); Alfred Stone, Providence, R. I.; Ass't Surg. Elliott Coues, U. S. A.; R. C. Greenleaf, Boston; Prof. O. W. Holmes, Boston; Prof. Francis S. Holmes, College of Charleston, S. C.; John J. Babson, Gloucester (May 28); O. C. Marsh, Yale College; George H. Moore, Libr. N. Y. Hist. Society (May 29); Prof. A. E. Verrill, Yale College; Prof. O. W. Holmes, Boston; Dr. James R. Nichols, Haverhill; Prof. W. P. Blake, San Francisco, Cal. (May 30); J. A. Allen, Springfield; E. N. Walton, Salem; Dr. S. A. Green, Boston; Edwin Bicknell, Boston; W. Merritt, Sup't Boston & Me. R. R. (May 31); Dr. Benj. Pickman, Highgate Springs, Vt. (June 1); C. C. Beaman, Jr., Washington, D. C.; Prof. F. S. Holmes, College of Charleston, S. C. (June 2); Prof. A. E. Verrill, Yale College; Dr. Wm. Stimpson, Sec't Chicago Academy of Science (June 3); W. M. Hunting, Fairfield, N. Y.; Charles Nauman, Lancaster, Pa.; W. Merritt, Sup't B. & Me. R. R.; John Ward Dean, N. E. Hist. Gen. Society (June 5); A. C. Goodell, Jr., Salem (June 6).

The Superintendent made a few remarks upon the singular habits of the Spade-footed Toad, *Scaphiopus solitarius*, and read a short communication from Mr. J. A. Allen, of Springfield, Mass., as follows:—

Springfield, May 29, 1866.

"I send you by to days express a living pair of what I take to be the Spade-footed Toad (*Scaphiopus*), which I obtained yesterday, May 28.

I found the first one at night, after the heavy rain of the 27th, in a path at the edge of a recently ploughed field, a quarter of a mile from any pond or running water. Several were heard during the evening in various directions, but they did not seem abundant, and the darkness prevented my obtaining any. The next morning my brother collected a pair which he found copulating in a little pool formed by the heavy rain. I visited the pool shortly after, but found only a single female, and she had already laid her eggs. Strings of eggs were attached to the grass growing in the water which, from their quantity and being placed in different parts of the pool, I concluded must have been deposited by two females. The pair obtained by my brother I placed in water, and during the day the female deposited her spawn. I frequently heard the notes of several other pairs, during the day, in different pools of water.

You will remember that I have repeatedly asserted that *Scaphiopus* occurred at Springfield, and that on more than one occasion I had heard their notes, the last time I heard them was about the end of June, 1863, after a succession of heavy showers had filled low places with temporary pools of water, when from noon 'til 11 P. M. all such pools and ponds resounded with their unmistakable croakings. They were then out in great numbers and undoubtedly spawned; but, being confined to the house by illness, I was unable to observe the fact or to obtain specimens.

Having observed this species spawning at Cambridge, early in the spring, their spawning here so late as June becomes the more interesting, and I think the time of spawning of this singular species is governed much by the wetness or dryness of the season.

This year water has not stood before in the places here frequented by them for the deposition of their ova. Two days ago the pool was dry, where yesterday they laid their eggs, and no other toads or frogs were about (they had all spawned long ago).

I shall observe the development of the eggs and tadpoles and will let you know about them."

Donations to the Museum and Library were announced.

A large display of native plants, the gleanings of the Botanists of the party during their forenoon rambles, having been placed on the table, Cyrus M. Tracy, of Lynn, was called upon, and spoke in his usual instructive manner of the different species, among which, were the Nodding Trillium, *Trillium cernuum*; Bellwort *Utricularia perfoliata*; Solomon's Seal, *Polygonatum biflorum*; Yellow Violet, *Viola pubescens*; Indian Turnip, *Arisarum triphyllum*; Cranesbill, *Geranium maculatum*; and then alluded to the peculiarities in the flora of this section of the county; the excellence of the soil for developing many rare and interesting plants, and had not concluded his interesting comments on the specimens before him when a shower commenced which increased to such an extent as to compel a speedy adjournment. This was followed by a succession of summer rainfalls which prevented the resumption of the business meeting, though detracting nothing from the hilarity of the party, who sought shelter as best they could until the arrival of the carriages which conveyed them back to the Town Hall.

The interruption of the meeting was unfortunate, as the material at hand afforded a variety of topics of the most interesting and instructive character. The Zoölogists had been quite successful in their collections and were pre-

pared to give an account of their doings. Many gentlemen from Havenhill, Boston, and other places were on the ground, who would, if opportunity had permitted, have furnished much useful and valuable information in regard to the civil and natural history of this section of the county.

The attentions of Dr. Nichols continued to the moment of departure, and to him the members of the Institute are under especial obligations for the pleasures and comforts of the day.

To Hon. Alfred Kittredge, James Gale, Esq., formerly of Salem, and many other citizens of Haverhill, thanks are due for kind attentions and agreeable hospitality.

The party returned by way of North Andover, Middleton, &c., at 5.30 P. M., greatly delighted with their days experience, and the meeting was adjourned to Friday noon at the rooms of the Institute.

The following letter received from Mr. John Bartlett, the well known and reliable collector of North American Naiades, is inserted here as being most appropriate in connection with this meeting, especially as Mr. Bartlett was present at the meeting, and would have been called upon for remarks if the rain had not caused so speedy an adjournment. It is to be hoped that similar lists and remarks, as these furnished by Mr. Bartlett, will be received from all parts of the county.—Editor.

Haverhill, July 2d, 1866.

F. W. PUTNAM;

Dear Sir: I advised you by mail that you might look out for a box of shells from me, for the Institute. I now forward it; but of course, from this quarter, you will not expect rare and beautiful specimens; the contents of the box will merely show you what exists in the waters of this neighborhood, and I send just what I could find, not the best specimens however, for these now sent were all dead shells when picked up, brought out by the musk-rats. No others could be found without dredging, and I was not prepared for that.

We have three ponds within one mile from the Town Hall, and not more than a quarter of a mile from each other. The largest is "Kenosa Lake," covering, it is said, three hundred acres; sandy bottom, with small stones and pebbles. The next in size is "Round Pond," fed by springs, a beautiful pond which supplies the town with water, and said to contain eighty acres; sandy and pebbly bottom. The smallest of the three is "Plug Pond," said to contain seventy acres; the eastern part is deep, sandy and stony; the western end shallow and muddy. Besides the above, in the West Parish, about four miles from the Town Hall, is another pond called "Creek Pond." I have not examined this thoroughly, but a short time since I traversed the N. E. side; not many shells were found; I collected, I suppose, a full assortment of such specimens as the pond affords. Creek Pond is rather shallow, and, where I examined, much grass on the bottom was found. In all the ponds I found the *Unio complanatus* Solander, perhaps forty times more numerous than all other species put together. A few *Unio rudutus* Barnes are found. The *Unio nasutus* Say is very rare; I never picked up a half dozen specimens here in my life. I am able, however, to send you one young shell, quite perfect, and a few odd valves; this shell (*nasutus*) is not found in Plug Pond, but in all the others. *Anodons* are found

in all the ponds, and seem all of the same species; I have not ventured to give the specific name; probably they are the *fluviatilis*; they are hardly thick enough for the *implicata*. I could not procure good specimens, they are fragile, and on the shores are found much broken; in the Fall, when the waters are low, specimens alive may be procured.

I send you also some specimens from the Merrimack River; my range has been about five miles on the Haverhill side,—say three above the railroad and two below. These river shells are also "Musk-rat shells," but most of them very fair; they were found under bushes and covered with mud and sand, and not injured by the sun.

What I send may not be wanted by the Institute for Cabinet specimens, but they may serve as a hint to the society to engage persons in the other towns of Essex County to "go and do likewise," which plan, well carried out, would give you a complete account of all the Naiades in the County. I should like to be engaged in making such an interesting collection. I have my eye on the ponds in Bradford, and the Bradford shore of the river, and it is not impossible that, after a while, I may be able to forward another box.

Some of the specimens now sent may do for the cabinet, if wanted; especially the *U. radiatus*, and the rayed specimens of *U. complanatus*. I would wash the outside with a sponge dipped in muriatic acid, very much diluted, and when dry put on the slightest possible coat of clear varnish with a sponge; the rays will then show distinctly.

Catalogue of Shells found in the ponds of Haverhill, Mass., and in the Merrimack River near that Town.

IN KENOZA LAKE. 300 Acres. *Unio complanatus* Solander; *Unio radiatus* Barnes; *Unio nasutus* Say; *Anodon* sp. ?; *Physa hercynostropha* Say.

IN ROUND POND. 80 Acres. *Unio complanatus*; *Unio radiatus*; *Unio nasutus*; *Anodon* sp. ?

IN PLUG POND. 70 Acres. *Unio complanatus*; *Unio radiatus*; *Anodon* sp. ?

I have never found *U. nasutus* in this pond.

IN CREEK POND. 300 Acres. *Unio complanatus*; *Unio radiatus*; *Unio nasutus*; *Anodon* sp. ?

IN MERRIMACK RIVER. *Unio cariosus* Say; *Unio complanatus* Solander; *Unio radiatus* Barnes; *Alasmodon undulata* Say.

In my searches recently I found no *U. radiatus* in the river, but a few years since I found numbers of them; had none on hand to put into the box.

The *Alasmodon undulata* is a very rare shell in the river at this locality. I was fortunate in finding one whole specimen and a single valve to forward with the others. I never found but four specimens here. Three years ago I picked up two very fair ones.

I am uncertain about *Anodons* in the river. I have not seen one near the river this season. I have examined among all the shells found in my range and have not seen a shell or a fragment of a shell of that genus. Some years since I collected shells in the river, but I have no list of them, and cannot say whether *Anodontia* was among them or not.

Among the quantities of *Unio complanatus* found on the shores of the ponds I have not seen a rayed specimen. All of this variety sent in the box were from a sandy point, from a mile and a half to two miles below Haverhill, on the shore of the river.

All the shells in the box appeared to have been dropped by the Musk-rats a good while since, as no animal matter was found on them."

Very respectfully yours,

JOHN BARTLETT.

FRIDAY, JUNE 8, 1866. Adjourned Meeting.

Vice President GOODELL in the Chair.

On motion of the Secretary it was *voted*: — That the thanks of the Essex Institute be tendered to our fellow member James R. Nichols, of Haverhill, for the kind attentions and generous hospitality extended to the members and their friends during the pleasant and long to be remembered visit of the Institute to Haverhill on Thursday the 7th of June, and that he be requested to thank those of his fellow citizens who extended courtesies on the occasion.

Charles S. Emmerton, of Salem, and Dr. Henry C. Perkins, of Newburyport, were elected Resident Members.

MONDAY, JUNE 18, 1866. Regular Meeting.

HENRY F. SHEPARD in the Chair.

Rev. Samuel C. Beane and Nathaniel C. Robbins, of Salem, and H. K. West, of Haverhill, were elected Resident Members. Professor Francis S. Holmes, of Charleston, S. C., was elected a Corresponding Member.

*Additions to the Museum and Library during April, May
and June, 1866.*

TO THE NATURAL HISTORY DEPARTMENT.

BY DONATION.

A FRIEND, Salem. A large and valuable collection, consisting of several thousand Shells, and several Echinoderms and Corals, from various localities. A collection of dried Grasses and various Plants.

ATWOOD, CAPT. N. E., Provincetown. Specimens of *Balistes* and *Aluteres*, from the North Atlantic.

BARTLETT, JAMES, Wenham. Skeleton of a Bittern, *Boturus lentiginosus*, from Wenham. Nest and Eggs of the Oriole, *Icterus Baltimore*, from Beverly.

BEMIS, MISS CAROLINE E., Chicopee. Collection of Shells, from St. Augustine, Fla.

CHAMBERLAIN, J. A., Salem. 24 specimens, 11 species of South Pacific and West Indian Shells.

COLCORD, MRS. H. M., South Danvers, 2 specimens of Pewee, *Sayornis fusca* and nest and eggs of the same, also nest and eggs of the Chip-Sparrow, from Danvers.

COOKE, CALEB, Salem. Embryos of the Black and White Creeper, Parasites from the Cod. Heads of *Sphyræna* and *Thynnus*, from the South Atlantic.

CREAMER, MISS CAROLINE. Lignite, from near Hyde Park, Vt.

DABNEY, MISS MARGARET, Salem. Specimen of Verd Antique Marble, from Port Henry, N. Y. Kaolin or China Clay, from Monkton, Vt. Slab containing Fossil Shells, from Lake Champlain, Vt.

EMERTON, JAMES H., Salem. Beetle from India Rhubarb Root. Larvæ and Pupæ of Gall Flies, from Oak Galls.

FELT, BENJAMIN, Salem. Polished specimen of the Oil Shale, from the West Moreland and Albert Mine, N. Brunswick.

FELT, S. Q., Salem. A twisted Vine, from ——— ?

GEERING, JAMES, Salem. Large Scale of a Sturgeon, from George's Banks.

GOLDSMITH, CAPT. JOHN, Salem. Skin of a Leopard, from Africa.

GROCE, MR., Beverly. Green Feldspar, from Beverly.

GROVER, WILLIAM, Salem. 3 Skates, 3 Flounders, 1 Lobster, from Salem Harbor.

HAMMOND, CAPT. JOSEPH, Salem. A valuable collection of Fishes, Crustaceans, Shells and Radiates, from the Sandwich and Falkland Islands. Collection of Mosses and Lichens, from the Falkland Islands.

HASKELL, ELIJAH, U. S. N. Specimen of *Madrepore*, from Mexico.

HUNTINGTON, MRS. G. C., Kelly's Island, Ohio. Minerals and Fossils, from Lowville, N. Y.

HIGBEE, C. H., Salem. 81 specimens, 42 species, of Insects ; 2 specimens, 2 species, of Lizards, from Egg Harbor, N. J.

HOTCHKISS, HENRY, New Haven, Ct. 2 specimens of *Blatta*, from a ship from Para.

JACOBS, MRS. H. M., Salem. Nest and Eggs of Red-eyed Vireo, from Salem.

KEMP, SAMUEL, Salem. Lump-Fish, *Cyclopterus lumpus*, from Salem Harbor.

KIMBALL, JAMES, Salem. 2 Lampreys and 2 *Alausa* sp., from Ipswich River. Several Minerals.

MANN, HORACE and BRIGHAM, W. T., Boston. 31 species of Ferns, from Hawaii, Sandwich Islands.

MERRILL, J. C., Cambridge. Collection of Spiders, from Cambridge.

MULLEN, CAPT. JOHN, Salem. *Syngnathus* sp., from the China Sea.

NICHOLS, ANDREW, Danvers. Humming Bird, from Danvers.

NICHOLS, JOHN, Salem. *Attacus cecropia*, from Salem.

PEABODY, FRANCIS, Salem. Specimens of the Whitebait, from the Thames, England.

PERKINS, DR. H. C., Newburyport. Cast of the Humerus of *Myiodon* found on the Walhammet River, Oregon.

PINNOCK, THOMAS, Salem. Iron pyrites taken from slate, from Vt.

PORTER, SAMUEL, Beverly. Specimen of *Seriola zonata*, from Beverly Harbor.

PRINCE, AMOS, Salem. Young Night Heron. *Nyctiardea Gardeni*, from North Salem.

PUTNAM, C. A., Salem. 2 young Linnets, from Salem.

PUTNAM, F. W., Salem. Oak Galls.

PUTNAM, CAPT. W. H. A., Salem. 3 specimens Ophiurans, from the China Sea. 5 specimens, 5 species, of Insects, from Siam; 9 specimens, 8 species, from Batavia. 17 Scorpions, Centipedes and Spiders, taken on board ship. 1 Annelid, from the Gulf weed. 375 specimens, 73 species, of Coral, from Singapore. A large collection of Fishes, from the China Sea and Gulf weed. 7 specimens, 6 species, of Reptiles, from Anjer; 1 specimen from China; 4 specimens, 3 species, from Batavia. 10 specimens, 5 species, of Birds, from Batavia and Atlantic Ocean. 78 skins, of 36 species of Birds, from the Molucca Islands. 1 Porpoise, from off the coast of United States. 1 Fetus of Sheep, from Anjer. 2 Rodents from Anjer. 374 specimens of Crustaceans, from the China Sea; 150 specimens, from Gulf weed. Several specimens of Mollusks, Holothurians, Echini and Star fishes, from the China Sea.

PUTNAM, MRS. W. H. A., Salem. A collection of Shells, from Caldera, Chili.

READ, G. F., Salem. Shells, from Nantucket. Horned Toad, from Texas.

ROBINSON, JOHN, Salem. 49 specimens, 15 species, of Ferns, from New England. Specimen of *Madrepore*, from Florida.

SANBORN, F. G., Boston. 2 eggs of *Nyctiardea Gardeni*, from Canton, Mass.

SUFFERT, E., Havana, Cuba. Collection of Shells, from Cuba.

TAYLOR, C. H., Salem. Fossil Shells and Corals, from a Brick yard at Newbern, N. C. 1 *Helix albolabris*, from Newbern, N. C.

THAYER, E. S., Salem. Specimen of Paraphine.

UPTON, WALTER, Salem. Minerals, from Paintville, Ky.

UNKNOWN. Skull of a Black Bear.

WEST, MISS MARY E., Salem. Male and female specimens of *Attacus Luna*, from near Bartholomew's Pond.

WILKINS, J., Salem. Skin of a Black Snake, from Ashburnham, Mass.

WHEATLAND, MRS. GEORGE, Salem. 3 specimens of Polished Agate, from near Bombay, India.

WHEATLAND, MISS M. G., Salem. Living specimen of *Cistudo Virginica*; several specimens of Corals, Sponges, Shells and Echinoderms, and a collection of Lichens, Mosses and Fungi, from St. Augustine, Fla.

WHEATLAND, CAPT. RICHARD, Salem. Tooth of a Whale.

YALE COLLEGE, CABINET OF, New Haven, Ct. 16 specimens, 10 species, of *Neuroptera*; 39 specimens, 19 species, of *Orthoptera*; 28 specimens, 19 species, of *Lepidoptera*, from Mass., Me., N. H. and Conn. Identified specimens.

TO THE HISTORICAL DEPARTMENT.

BY DONATION.

BROWNE, ALBERT G., Salem. Relics from Andersonville Prison.
 GOODWIN, ENOCH, Newburyport. An Indian Stone Hatchet, found
 in Belleville (Newbury).

HAMMOND, CAPT. JOSEPH, Salem. "Figure head" from the prow
 of an Ancient War Vessel of the Natives of the Kingsmills Islands.

OSBORN, J., Salem. A land Torpedo taken from Salient Number
 two of the Confederate Fort Esperanza.

PERRY, AUGUSTUS, Salem. Plaster Bust of Nathaniel Bowditch.

PULSIFER, DAVID, Boston. Relic from Gov. Hancock's House,
 Boston. A Rifle found near the place where the mine exploded at Pe-
 tersburg, Va.

PUTNAM, CAPT. W. H. A., Salem. A Dutch silver coin (6 stivers).

ROBINSON, JOHN, Salem. A Wash Bowl made from the brass ball
 on the Third "First Church" of Salem. Feather Work from South
 America.

ROPEZ, MISS SUSAN, Salem. Two Native Dish Covers, from Zan-
 zibar.

TAYLOR, C. H., Salem. Relics from the Battlefield of Newburn.

TO THE LIBRARY.

BY DONATION.

ALLEY, JOHN B., M. C. Commerce and Navigation of United
 States, 1863 and 1864, 2 vols., 8vo. Smithsonian Report for 1863, 1 vol.,
 8vo. Commercial Relations, 1864, 1 vol., 8vo. Report on the Conduct
 of the War, 1865, 3 vols., 8vo. Message and Documents, 1864-5, 4 vols.,
 8vo. Report on Internal Revenue, 1 vol., 8vo, 1865. Patent Office
 Report, Arts and Manufactures, 1862, 2 vols., 8vo. 9 Pamphlets.

BACHE, A. D., Sup't Coast Survey. Coast Survey Report for 1863,
 1 vol., 4to.

BLAKE, WILLIAM P., San Francisco, Cal. Annotated Catalogue of
 Minerals of California by W. P. Blake, 8vo, pamph., Sacramento, 1866.

BLAND, THOMAS, New York. Remarks on the Operculated Land
 Shells of America, 8vo, pamph.

BROOKS, HENRY M. 10 Pamphlets.

CHAPMAN, JOHN, Mass. Legis. Doc. for 1842 and 1843, 4 vols., 8vo.

CHASE, GEORGE C., Friends Review, 20 numbers.

COLCORD, MRS. H. M., South Danvers. Billing's Singing Master's
 Assistant, 1 vol., Boston, 1781.

COUES, ELLIOTT, U. S. Army. Prodrôme of a work on the Orni-
 thology of Arizona Territory, 8vo, pamph., Philadelphia, 1866.

- CROSBY, ALPHEUS. A collection of various Newspapers.
- DALAND, W. S., New York. New York Directory for 1863 and 1865, 2 vols., 8vo.
- DALL, WILLIAM H., San Francisco, Cal. Dall's Memorial Sketch of Thos. Bridges, 8vo, pamph., San Francisco, 1866.
- DALTON, SAMUEL. A Collection of Mss. Letters, &c.
- DAVIDS, T. W., Colchester, England. David's Annals of Evangelical Nonconformity in Essex, 1 vol., 8vo, London, 1863.
- FOOTE, CALEB. 46 Pamphlets.
- GREEN, SAMUEL A., Boston. 175 Pamphlets. Flint's Report on Agriculture of Mass. for 1865-6, 8vo, 1 vol.
- HANAFORD, MRS. P. A., Reading. Ladies' Repository for May 1866, 8vo, pamph.
- HART, CHARLES H. Ruggles' Address at the Opening of the Metropolitan Fair, April, 1864, 8vo, pamph. The Three Days Battle of Chattanooga, Nov., 1863, 8vo, pamph.
- HOLMES, FRANCIS S., Charleston, S. C. Pleiocene Fossils of South Carolina by M. Tuomey and F. S. Holmes, 1 vol., 4to, Charleston, 1857. Post Pleiocene Fossils of South Carolina by F. S. Holmes, 1 vol., 4to, Charleston, 1860.
- HOTCHKISS, MISS SUSAN V., New Haven, Ct. New Haven Directories for several years, 7 vols., 12mo. Several Pamphlets.
- HOVEY, EDMUND O., Wabash College, Ind. 31st Annual Catalogue of Wabash College, 1864-5, 8vo, pamph.
- HOW, HENRY, King's College, Windsor, N. S. Contributions to the Mineralogy of Nova Scotia, 8vo, pamph. Report on Mines of Nova Scotia, 8vo, pamph. Report on Certain Minerals found by Dr. Honyman, 8vo, pamph.
- HUNT, THOMAS. Christ and the People, by A. B. Child, 1 vol., 12mo, Boston, 1866.
- INNIS, MRS. JOHN A. Saturday Evening Post from 1829 to 1843, incl., 6 vols., folio, Philadelphia.
- JOCELYN, MISS MARY E. Spirit of Pilgrims for 1863-4. 2 vols., 8vo.
- KENDIG, A. B., Iowa City, Iowa. Catalogue of Cornell College for 1864-5, 8vo, pamph.
- KIMBALL, MRS. ELIZABETH. The Liberator for 1865. 1 vol., folio.
- KIMBALL, JAMES. Proceedings of Roy. Arch. Chapter of Mass. from Dec., 1864 to Oct., 1865, 8vo, pamph.
- LATOUR, L. A. HUGUET-, Quebec, Canada. Report on the Crown Lands of Canada, Dec. 31. 1865, 8vo, pamph. Annuaire de Ville-Marie, premiere annee 1863, 1 vol, 8vo.
- LEWIS, WINSLOW. Boston. Conditions of Success in Genealogical Investigations by Fowler, 8vo, pamph. Sibley's Notices of Trien. Catalogue of Harv. Univ., 8vo, pamph.

MARSH, O. C., New Haven, Ct. *Marsh's Description of an Ancient Sepulchral Mound near Newark, Ohio*, 8vo, pamph., New Haven, 1866.

MUNSELL, JOEL, Albany. *Albany Directories for several years*, 19 vols., 12mo.

NELSON, H. M., Georgetown. *Annual Reports of 24 towns of Essex County for 1865*. 41 Pamphlets,

PAGE, CHARLES D., Groveland. *Howard's Sermon at Groveland*, Jan. 25, 1865, 8vo, pamph.

PAINE, NATHANIEL, Worcester. *6th Annual Report of the Directors Worcester Free Public Library*, 8vo, pamph.

PERKINS, GEORGE. *Monthly Journal of American Unitarian Association*, 12 numbers, 12mo.

PERLEY, JONATHAN. *Annual Report of Expenditures and Receipts of Ipswich*, 1865, 8vo, pamph.

PHILLIPS, STEPHEN H. *Bill and Answer to Bill, Mass. vs. R. I. (Boundary Question)*, 4to, pamph., 1852-60.

PICKMAN, BENJAMIN. *The Nation*, several numbers.

PUTNAM, MRS. ELIZABETH A. 32 Pamphlets.

RANTOUL, R. S. *Papers relating to Salem Union League*.

RICE, WILLIAM, Springfield. *Annual Report of Springfield City Library*, 1866, 8vo, pamph.

SCHAEFFER, G. A. W. HERRICH-, Regensburg, Germany. *Die Schmetterlinge der Insel Cuba, Erste Lieferung*, 8vo, pamph. *Prodromus Systematis Lepidopterorum*, 8vo, pamph.

STICKNEY, M. A. *Daily Dispatch*, Richmond, April 19, 1866.

STONE, B. W. *Philadelphia Directory for 1864*, 1 vol., 8vo. Several pamphlets.

SUMNER, CHARLES, U. S. Sen. *Cresswell's Life and Character of Henry Winter Davis*, 1 vol., 8vo, Washington, 1866. 5 Pamphlets.

UPHAM, O. W. H. Several numbers of the *High School Gazette*.

UPTON, JAMES. *Atlantic Monthly*, vols. 13 and 14. *American Baptist Missionary Magazine*, vols. 44 and 45. *Living Age*, vols. 27, 28, 29, 30, 31 of the 3d series.

WARD, CHARLES. "Our Daily Fare," a paper in 12 nos., and other pamphlets relating to the Great Central Fair in Philadelphia, June, 1864.

WHEATLAND, MISS MARTHA G. *Boston Daily Journal*, from Jan'y to July, 1866.

WYMAN, JEFFRIES, Cambridge. *Wyman's Notes on the Cells of the Bee*, 8vo, pamph., Cambridge, 1866.

YOUNG, S. I., Bowdoin College. *Catalogue of Bowdoin College*, 1866, 8vo, pamph., and other pamphlets relating to the College.

BY EXCHANGE.

AMERICAN ANTIQUARIAN SOCIETY. Proceedings of meetings of March 16 and April 25, 1866, 8vo, pamph.

BOSTON SOCIETY OF NATURAL HISTORY. Proceedings, vol. 10. pages 145 to 320.

BUFFALO YOUNG MEN'S ASSOCIATION. 30th Annual Report, 8vo. pamph.

CANADA GEOLOGICAL SURVEY. Report of Progress to 1863, 1 vol., 8vo, Montreal, 1863.

CANADIAN INSTITUTE. The Canadian Journal for April, 1866, 8vo. pamph.

CHICAGO ACADEMY OF SCIENCE. Proceedings, vol. 1, pp. 1 to 48.

EDITORS. American Journal of Science, for May.

American Mining Index, for April, May and June.

Beadle's Monthly, for May.

Dublin Quarterly Journal of Science, for April.

Essex Banner, . . . for April, May and June.

Gardener's Monthly, " " " " "

Gloucester Telegraph, " " " " "

Haverhill Gazette, " " " " "

Historical Magazine, " " " " "

Lawrence American, " " " " "

Lynn Reporter, " " " " "

Salem Observer, " " " " "

South Danvers Wizard, " " " " "

Trübner's American and Oriental Literary Record, Apr. and May.

FIRELANDS HISTORICAL SOCIETY. The Firelands Pioneer for June. 1866, 8vo, pamph.

IOWA STATE HISTORICAL SOCIETY. The Annals of Iowa, for April, 1866, 8vo, pamph.

MASSACHUSETTS HISTORICAL SOCIETY. Proceedings, 1864-5, 1 vol., 8vo.

MUSEUM OF COMPARATIVE ZOOLOGY AT CAMBRIDGE. Annual Report of Trustees, for 1865, 8vo, pamph.

NEW ENGLAND HISTORIC-GENEALOGICAL SOCIETY. Lewis's Valedictory Address, Feb. 7, 1866, 8vo, pamph.

NEW HAMPSHIRE HISTORICAL SOCIETY. Collections, vol. 8, 8vo, Concord, 1866.

NEW JERSEY HISTORICAL SOCIETY. Proceedings, vol. 10, No. 2.

NEW YORK CHAMBER OF COMMERCE. 8th Annual Report, 1865-66, 1 vol. 8vo. 54 pamphlets.

NEW YORK MERCANTILE LIBRARY ASSOCIATION. Catalogue of Books in Library, 1 vol., 8vo, New York, 1866.

OHIO MECHANIC'S INSTITUTE. 38th Annual Report, 8vo, pamph., Cincinnati, 1866.

PEABODY INSTITUTE, South Danvers. 14th Annual Report of Trustees, 8vo, pamph.

PHILADELPHIA ACADEMY OF NATURAL SCIENCES. Proceedings for Jan'y, Feb. and March, 1866, 8vo, pamph.

PHILADELPHIA ENTOMOLOGICAL SOCIETY. The Practical Entomologist, vol. 1, Nos. 6, 7, 8.

RHODE ISLAND HISTORICAL SOCIETY. Colonial Records, vol. 10, 8vo, Providence, 1865.

SAINT LOUIS ACADEMY OF SCIENCE. Transactions, vol. 2, No. 2, 8vo, pamph.

U. S. SANITARY COMMISSION. Ages of U. S. Volunteer Soldiery, 8vo, pamph., New York, 1866.

WISCONSIN STATE HISTORICAL SOCIETY. Dedicatory Addresses, Jan'y 24, 1866, 8vo, pamph.

ZOOLOGISCHE GESELLSCHAFT, Frankfurt, a M. Der Zoologische Garten. vol. 6. Nos. 7, 8, 9, 10, 11, 12.

FRIDAY, JULY 6, 1866. Field Meeting at Asbury Grove. Hamilton.

The second Field Meeting of the season was held at the Camp Meeting Grounds in Hamilton, by permission of the Association owning this beautiful grove.

The morning rambles extended over the various woods, fields and meadows in the vicinity of the grove; many of the party visiting Pleasant Pond, which was reached by a fine shaded walk through the woods.

On the return of the various parties a most welcome collation was partaken of in the dining hall and the numerous party then assembled in the grove, where, at 3 o'clock in the afternoon, the meeting was called to order with

Vice President GOODELL in the chair.

Letters received since the last meeting were announced from the following:—Prof. A. E. Verrill, Yale College (May 12); Prof. S. F. Baird, Smithsonian Institution (May 18); Henry A. Smith, Cleveland, Ohio (May 20); J. W. Lefavour, Beverly (May 22); Dr. J. E. Holbrook, Charleston, S. C. (May 25); Corporation of Williams College (June 6); C. D. Page, Groveland (June 7); Maine Historical Society (June 9); Dr. James R. Nichols, Haverhill; Ass't Surg. Elliott Coues, U. S. A. (June 10); A. Agassiz, Museum Comp. Zoology; Chicago Academy of Science; American Antiquarian Society (June 12); Capt. N. E. Atwood, Provincetown; S. Jillson, Feltonville; Dr. Henry C. Perkins; Prof. Joseph Henry, Sec'y Smithsonian Institution (June 14); H. A. Cutting, Lunenburg, Vt.; Prof. A. E. Verrill, Yale College (June 15); E. W. Hubbard, Tottenville, N. Y. (June 16); Rev. J. E. Long, Hublersburg,

Pa. (June 17); W. M. Gabb, Palæontologist, California Survey, San Francisco, Cal. (June 18); W. G. Richardson, Oxford, Miss.; State Hist. Society of Iowa; Prof. O. W. Holmes, Boston; H. Challen, Philadelphia (June 20); Rev. A. B. Kendig, Marshalltown, Iowa; N. Paine, Worcester; E. W. Buswell, Malden; Prof. J. P. Kirtland, Cleveland, Ohio; Wm. Couper, Quebec, Canada; Prof. D. S. Sheldon, Davenport, Iowa (June 22); Prof. R. Owen, Ind. State University (June 23); Henry K. West, Haverhill; Rev. E. C. Bolles, Portland, Me. (June 25); Prof. S. F. Baird, Smithsonian Institution (June 26); John Bartlett, Haverhill; Prof. A. E. Verrill, Yale College (June 28); Ass't Surg. Elliott Coues, U. S. A., Columbia, S. C.; Thomas Bland, New York (June 29); W. F. Goodwin, Lib. N. H. Historical Society; Samuel H. Wadleigh, Georgetown; W. H. Dall, Acting Director Scientific Corps, Behring Strait Telegraph Co., San Francisco, Cal.; Gen'l Albert Ordway, Richmond, Va. (July 1); John Krider, Philadelphia, Pa.; G. Peabody Russell, Haverhill (July 2); John H. Thomson, New Bedford; John Bartlett, Haverhill; Prof. D. S. Sheldon, Davenport, Iowa (July 5).

Donations to the Museum and Library were announced.

The chair made a few remarks respecting the place of the meeting, and the kindness of the Association in allowing the Institute to occupy the grounds, and called on Mr. James F. Almy, of Salem, a member of the Association for an account of the origin of the "Camp Meetings" held in this place. Mr. Almy responded as follows:—

MR. PRESIDENT:—I esteem it meet that a field meeting of the Essex Institute should be held on the grounds of the Asbury Grove Camp Meeting Association.

Religion and science may well walk with joined hands. If it may be truly said, "The undevout astronomer is mad," so he who searches out the wonderful Chart of nature, must avow the handiwork of God.

You have invited me to speak of Camp Meetings, of the one that meets in this grove, and the name it bears. The idea is ancient, and all through the history of our race, a sense of duty has seemed to fill the hearts of men, impelling them to withdraw from the daily routine of care and labor, that they might have closer and uninterrupted communion with God. It was the prayer of Moses and Aaron before Pharaoh, that they might, for this purpose, journey into the wilderness. The Jewish feasts were such seasons of worship. Christ and the apostles gathered the multitudes by the way. It was not the purpose of John Wesley, the great founder of this denomination, to break away from the protection or usages of the Church of England, but he met such opposition in his work of reform, that church doors were closed against him, and he was driven into the fields, where great masses met him to listen to the word. The system of Camp Meetings, like the one which meets annually here, originated in this country. In 1799, two brothers travelling in Kentucky, began a meeting in a Presbyterian Church, to which the people from the surrounding country came in great numbers. It continued for days, the people encamping near by. So the Presbyterians held the first Camp Meeting in America. The Baptists have also held them; but it was reserved for the Methodists to adopt them generally.

This Association was formed in 1859. The first meeting was held

in August of that year. Attendance on the first day, about 2,000, increased to 15,000 before it closed. Each succeeding year has been a success. Great good has been accomplished through the blessing of God, and this camp meeting is firmly established in the hearts of the people. The grounds are held by purchase and lease.

Francis Asbury, the name by which this Association is called, is that of the first superintendent and resident Bishop in this country, and is, to us, a name of blessed memory. He was born in the year 1745, in the parish of Handsworth, in Staffordshire, England. He was converted at fourteen years of age, and at twenty-one, he was travelling and preaching under the Wesleys. This was in 1766, the natal year of Methodism in America. In Sept., 1771, he sailed for these shores, and landed in Philadelphia after a wearisome voyage of fifty days. He at once entered upon that peculiar labor that was followed by him through forty-five years to the end of his life—the life of a Statesman, Evangelist and Bishop combined. He found in America, only ten ministers and six hundred members of this church. At his death there were 211,000 members, and 3,000 ministers. His sermons in this country are estimated at 16,500, or one for every day in all these years. His travels, on horseback entirely, throughout the whole length and breadth of the region inhabited by civilized men, in the States and Canadas, at 270,000 miles, or 6,000 per year. He presided at two hundred and twenty-five annual conferences, and ordained more than 4,000 preachers. These conferences must have required the consecutive time of four years. In 1784, the connection with England was severed, and Bishop Coke was sent over to ordain Asbury for the bishopric, and head of the church on this Continent. It will be impossible for us to bestow even a cursory glance at the subsequent work of this wonderful man; but whoever will read his life and study its connection with the church in this country, will say that he was the greatest christian organizer in our history, and that he has wrought more deeply into the religious thought and feeling of the country than any other. He was constantly upon his travels. His name was a household word, and the children loved him. In the spring of 1816, in his 71st year, he is upon his great tour. He has come up through the Carolinas into Virginia. He is in Richmond, worn, weak and sick, but it is the Sabbath, and he must preach. Kind friends bear him in their arms into the church and seat him in the midst of the multitude that had thronged to hear him once more. His text was, "For he will finish the work and cut it short in righteousness." It was his last effort, and he died within a few days near Fredericksburg. His ashes rest in the city of Baltimore. His life was one of constant travel and toil. He had no home on the earth. His salary was sixty-four dollars per annum, from which, for years, he contributed to the support of an aged mother in England; but the result of his labor is a present membership of the Methodist Episcopal Church in the United States of 2,000,000, with an affiliated population of 8,000,000.

Mr. G. D. Phippen, gave an account of the floral collections made during the morning, which, owing to the great heat of the day, were quite small for this region.

Mr. Phippen concluded his remarks by reading a paper from Mr. SAMUEL H. WADLEIGH, of Georgetown, upon the Indian Pipe, *Monotropa uniflora*, which Mr. Wadleigh thought should not be regarded as a

parasite, as it did not attach its root to the living parts of other plants, but merely located itself near their decayed roots and leaves. He also thought that this singular plant should be taken from the great order of Heaths (*Ericaceæ*), and be considered, perhaps, an order by itself.

Mr. F. W. Putnam, called attention to the various zoölogical specimens that had been collected, and explained the development of several kinds of Insects, and mentioned the species of Fishes and Reptiles found in the vicinity.

Dr. B. G. Wilder, of Boston, gave an interesting account of the manner in which spiders construct their webs, and gave the results of his experiments on the silk producing spider, *Nephila plumipes*, found on the Islands of South Carolina.

Hon. Allen W. Dodge, of Hamilton, offered a few general remarks, called forth by the last speaker, and alluded to the subject of selecting the proper kind of shade trees for particular situations; the various improvements in the town of Hamilton; the manufacture of Peat, etc.

Hon. Samuel P. Benson, of Winthrop, Me., spoke in a humorous and instructive manner illustrative of the necessity of acquiring knowledge, and bid the Institute "God speed" in awakening a stronger taste for scientific attainments.

The chair spoke of the recent fire in Portland, regretting the great loss of property, more especially that which cannot be replaced, as records, collections, old relics and memorials. The following resolution was then offered by Mr. J. A. Goldthwaite, and unanimously adopted.

Resolved:—That the Essex Institute, learn, with deep regret, the great loss which the PORTLAND SOCIETY OF NATURAL HISTORY have sustained by the destruction of their building and collections during the great fire at Portland, on Wednesday, the 4th inst.

Voted:—That the Institute consider it their duty to extend a helping hand to their sister society in this great bereavement, and direct the Curators to offer to them a suite of the duplicates in the Library and Collections of the Institute whenever they may be prepared to receive contributions.

Mr. E. N. Walton offered the following resolution, which was adopted.

Resolved:—That the thanks of the Institute be presented to the Asbury Grove Camp Meeting Association, through Messrs. Almy, Magee, Noyes, Richardson and Waite, for their kindness in allowing us to hold a meeting in this grove to day; to Messrs. James W. Patch and Joseph F. Dodge for their attentions; to Messrs. James Bartlett, of Wenham, and Joseph Conant and Charles Tuck, of Hamilton, for their services as guides; and to other friends who have contributed to render the meeting so attractive and interesting.

The following persons were elected Resident Members:—Nathan P. Meldrum, of Beverly; James Bartlett, of Wenham; Warren Ordway,

of Bradford; Moses Howe, Austin P. Nichols, and James Gale, of Haverhill.

MONDAY, JULY 16, 1866. Regular Meeting.
Vice President GOODELL in the chair.

The following persons were elected Resident Members:—John Mullen and Thorndike D. Hodges, of Salem; Thomas Scott Abbott and Edwin Genn, of Beverly; William L. Weston and John H. Sears, of Danvers.

THURSDAY, AUGUST 2, 1866. Field Meeting at Manchester.

This meeting was very largely attended. The morning was spent as usual in rambles to the various interesting localities in the neighborhood. The botanists sought the woods, which here offer one of the finest resorts for their researches. Another party went to "Kettle Cove," which presents much of Geological interest, and other parties to the ponds; but by far the larger number were attracted to the seashore, where "Eagle Rock" and the several fine beaches offered great attractions. The "Musical Sands," which are situated on part of what is known as the "Old Neck Beach," were visited by many, and considerable interest was manifested in this rare and singular phenomenon.

Hugh Miller, in his "Cruise of the Betsey; or, A Summer Ramble among the Hebrides," p. 75, describes a phenomenon so similar to the one observed on the beach in Manchester, that we cannot give a better description of our "Musical Sands" than copy the account of his. "I was turning aside this sand of the Oölite, so curiously reduced to its original state, and marking how nearly the recent shells that lay embedded in it resembled the extinct ones that had lain in it so long before, when I became aware of a peculiar sound that it yielded to the tread, as my companions paced over it. I struck it obliquely with my foot, where the surface lay dry and incoherent in the sun, and the sound elicited was a shrill, sonorous note, somewhat resembling that produced by a waxed thread, when tightened between the teeth and the hand, and tipped by the nail of the forefinger. I walked over it, striking it obliquely at each step, and with every blow the shrill note was repeated. My companions joined me; and we performed a concert, in which, if we could boast of but little variety in the tones produced, we might at least challenge all Europe for an instrument of the kind which produced them. It seemed less wonderful that there should be music in the granite of Memnon, than in the loose Oölitic sand of the Bay of Laig. As we marched over the drier tracts, an incessant *woo, woo, woo*, rose from the surface, that might be heard in the calm

some twenty or thirty yards away; and we found that where a damp semi-coherent stratum lay at the depth of three or four inches beneath, and all was dry and incoherent above, the tones were loudest and sharpest, and most easily evoked by the foot. Our discovery—for I trust I may regard it as such—adds a third locality to two previously known ones, in which what may be termed the musical sand—no unmeet counterpart to the “singing water” of the tale—has now been found. And as the island of Elgg is considerably more accessible than *Jabel Nakous*, in Arabia Petræa, or *Reg-Rawan*, in the neighborhood of Cabul, there must be facilities presented through the discovery which did not exist hitherto, for examining the phenomenon in acoustics which it exhibits,—a phenomenon, it may be added, which some of our greatest masters of the science have confessed their inability to explain.”

At one o'clock the party reassembled at the Chapel of the First Baptist Society, and, after the collation, adjourned to the Congregational Church, where the regular meeting was organized at two o'clock, with Vice President GOODELL in the chair.

The meeting was opened by a voluntary on the organ and singing by the church choir.

After the reading of the records of the last meeting, letters were announced from the following:—

Henry d' Alligny, Houghton, Mich.; Dr. B. G. Wilder, Boston; Capt. A. Hyatt, New York; T. A. Cheney, Havana, N. Y.; New Orleans Academy of Science (July 8); Horace Mann, Cambridge; Prof. H. C. Wood, jr., Philadelphia; C. J. Maynard, Newtonville; Rev. E. C. Bolles, Portland; Rev. J. C. Fletcher, Newburyport (July 9); E. S. Morse, Portland, Me.; Surgeon Elliott Coues, U. S. A., Columbia, S. C. (July 10); A. M. Edwards, New York; John Bartlett (July 12); Dr. B. G. Wilder, Boston; T. A. Cheney, Watkins, N. Y. (July 13); John H. Thomson, New Bedford (July 14); Prof. A. E. Verrill, Yale College; Dr. B. G. Wilder, Boston (July 16); E. S. Morse, Portland, Me. (July 17); B. F. Molin, Indianapolis, Ind.; W. D. Hartman, Westchester, Pa. (July 18); Prof. E. J. Pickett, Rochester, N. Y.; T. P. Gentlee, Manchester (July 19); W. L. Weston, Danvers; Warren Ordway, Bradford (July 20); W. Wood & Co., New York; Prof. A. E. Verrill, Yale College (July 22); Dr. S. C. Williams, Silver Springs, Pa.; Dr. A. S. Packard, Boston; Dr. B. G. Wilder, Boston; W. H. Dall, San Francisco, Cal.; H. A. Cutting, Lunenburg, Vt.; A. P. Nichols, Haverhill; Maine Historical Society (July 23); Dr. B. G. Wilder, Boston; American Antiquarian Society; Solomon Lincoln, Boston; Pennsylvania Historical Society (July 24); Dr. B. G. Wilder, Boston; S. L. Boardman, Augusta, Me.; W. W. Butterfield, Indianapolis, Ind.; J. P. Haskell, Marblehead; Corporation of Yale College (July 27); E. S. Morse, Portland, Me.; T. P. Gentlee, Manchester (July 28); Prof. E. J. Pickett, Rochester, N. Y.; P. R. Uhler, Cambridge; State Historical Society of Iowa; F. S. Pease, Albany, N. Y. (July 30); Dr. B. G. Wilder, South Yarmouth; Dr. S. A. Green, Boston; S. L. Boardman, Augusta, Me.; Mrs. P. A. Hanaford, Boston; Moses Howe, Haverhill; Franklin Haven, Boston (Aug. 1).

Donations to the Museum and Library were announced.

The Superintendent read the following communication, by title: "*List of Birds observed at Hamilton, Canada West, by Thomas McIlwraith.*" Referred to the Publication Committee.

The chair, after a few general remarks on the history and objects of the Institute, invited Vice President S. P. Fowler to report upon his observations in the woods of the vicinity.

Mr. Fowler gave a general account of the trees he had noticed in the woods, mentioning in particular several kinds of Oaks, Birches, Maples, American Mountain Ash, the celebrated Magnolia, and a *Sassafras* tree that was seven and a half feet in circumference, and which he thought was the largest tree of this species in the state.

Mr. G. D. Phippen followed with an account of the plants on the table, calling special attention to the very beautiful Pond Lilies which had been collected in the pond at Kettle Cove, and which were remarkable for their rose tint.

Mr. F. W. Putnam gave a short account of the Dog-fish, large numbers of dead ones from which the livers had been taken having been found washed up on the beach. The Dog-fish has now become important with the fishermen on account of the oil which is obtained from their livers. At Cape Cod this fish is also used for fuel, after having been dried, and burns with great freedom, the whole fish being very oily. This species brings forth living young, one of which, taken from the mother, was exhibited at the meeting.

Mr. Alpheus Hyatt, of the Boston Society of Natural History, exhibited a number of fresh-water sponges which he had collected in Kettle Cove Pond, and described their compound structure, showing that they were composed of numerous minute single-celled animals or Monads. These Monads having, for such minute creatures, a remarkably complicated organization; being possessed of a pulsating vesicle, the analogue of the heart in man, and a portion of the body, which might be defined as a mouth. These facts had recently been discovered by Prof. H. J. Clark, of Cambridge, one of the most distinguished microscopists in the country, who had by his recent researches thus proved beyond a doubt that the sponges are not plants but true animals, and that though among the lowest forms of the Animal Kingdom, they exhibit the tendency, which is observed in all animals, to develop a cephalic portion, or a head.

Mr. Hyatt also spoke of another discovery made by Prof. Clark, who had shown that the *amœba*, a mere drop of sentient animal jelly, also possessed one portion of its jelly-like body which was peculiarly marked, and always preceded the rest of the body,—thus showing a tendency to Cephalization.

Mr. R. S. Rantoul alluded to the completion of the Atlantic Telegraph, and, after a few appropriate observations, offered the following preamble and resolutions:—

The past week has been marked by a scientific event, in the establishment of Telegraphic Communication across the bed of the Atlantic Ocean, of such grand import,—so full of hope and encouragement,—so great a step in the onward and upward march of human destiny, laying civilization under new obligations to science,—that it cannot be suffered by the Institute to pass without a grateful recognition. Be it therefore

Resolved, That we recall with pride, to-day, that Franklin, who linked his name with the first practical researches into the nature of the electric fluid, demonstrating its magnetic qualities and its identity with lightning, was a native of Massachusetts; that Morse, the father of the present world-embracing system of communicating intelligence by the aid of that force, was a native of Massachusetts; and it was well that Field, another son of Massachusetts, should be so largely instrumental in the success of that great enterprise which has at last interpreted, as with the finger of the lightnings, the mystery of Solomon: "For, which is most to be wondered at, the fire had more force in the water—it burneth even in the midst of water—for Thou hast made a way in the sea, and a safe path in the waves."

Resolved, That the Essex Institute felicitates all those whose faith in Science, long and sorely tried but never wavering, has been rewarded by this auspicious and seemingly satisfactory result.

The Chairman, observing that several distinguished visitors, of national reputation, were present, expressed the hope that they would favor the meeting with some remarks on a subject of such commanding importance, having such a direct bearing upon international interests, and called upon Chief Justice Chase to respond.

The Chief Justice, after some humorous allusions to those who accompanied him, mentioned that he was retained as counsel in one of the earliest Patent cases growing out of the invention of the Electric Telegraph. At that time he studied the subject very minutely, and he proceeded to give a brief and very interesting outline of the history of this science and its application as it occurred to his recollection. He closed with the remark that Divine Providence calls upon some men to prepare the way for progress in civilization, and that all great discoveries follow the successive aggregation of several minds, each contributing an essential link in the great chain of progress.

Maj. Gen. Butler was next introduced, and after some complimentary allusions to the Chief Justice, who, he said, had so exhausted the subject of the Telegraph that nothing remained for him to say, General Butler remarked that the wants of the future progress of civilization were worthy of a moment's attention. The first was a speedier mode of transit, alluding to the attempts lately made for the navigation of the air, and it seems probable that where so many minds are employed on this problem, some good results should be obtained, and that many

of the difficulties were now surmounted in the machines already constructed or in process of construction. He then spoke of a machine for registering the expressions of the human voice; forty wires were to be suspended before the speaker, each correspondent to one of the forty sounds of the voice, and attuned to different key-notes. Each different sound uttered would produce a vibration upon one of these wires, striking its "fundamental note," and would produce no effect upon the other wires. The effect would be communicated by electricity to a machine for setting types, thus the remarks of a speaker would be transferred immediately from speech to type.

The hour having now arrived for adjournment in order to reach the return train seasonably, there was no time for further addresses,—a fact much regretted, as there were several eloquent gentlemen present who would have made remarks had time permitted.

The resolutions offered by Mr. Rantoul were seconded by Gen. H. K. Oliver, and unanimously adopted.

Mr. Charles Davis, of Beverly, offered the following, which was adopted:—

Resolved, That the thanks of the Essex Institute are due to the proprietors of the First Congregational Society, and the First Baptist Society, for the use of their house and vestry during the meeting this day; and also to Thomas P. Gentlee, John Price, John Lee, A. W. Jewett, William Russ, Nehemiah Marshall, Walter V. Crafts, David Kimball, Nathan P. Meldrum, John Little, Thomas W. Slade, Claudius B. Hoyt, and Abraham Goldsmith, for their assistance and attentions to the members and friends of the Institute present with us this day.

THURSDAY, AUGUST 9, 1866. Adjourned Quarterly Meeting.

Rev. G. D. WILDES in the chair.

The proposed amendment to the Constitution was read for the second time.

The Superintendent submitted the following amendment to the By-Laws.

Chapter III. DEPARTMENTS. Paragraphs one and two to be so amended by the addition of the sections of *Archæology*, *Protozoa*, and *Microscopy*, as to read as follows:—

The HISTORICAL DEPARTMENT shall be divided into four sections: 1, *Archæology*; 2, *Ethnology*; 3, *Manuscripts*; 4, *Fine Arts*.

The NATURAL HISTORY DEPARTMENT into eleven sections: 1, *Geology*; 2, *Mineralogy*; 3, *Palæontology*; 4, *Botany*; 5, *Comparative Anatomy*; 6, *Vertebrata*; 7, *Articulata*; 8, *Mollusca*; 9, *Radiata*; 10, *Protozoa*; 11, *Microscopy*.

Dr. A. S. Packard, jr., was elected a Curator of *Articulata* and *Radiata*.

Alpheus Hyatt was elected a Curator of *Palæontology* and *Protozoa*.

George Peabody Russell was elected a Curator of *Archæology*.

The following amendment to By-Laws was adopted:—

Any Corresponding Member, taking up his residence in the County, becomes a Resident Member.

Arthur M. Edwards, of New York, and Hiram A. Cutting, of Lunenburg, Vt., were elected Corresponding Members.

MONDAY, AUGUST 18, 1866. Regular Meeting.

ANDREW LACKEY, Esq., in the chair.

Samuel L. Caldwell and Reuben A. Guild, of Providence, R. I.; George H. Clark, of Hartford, Ct.; Alvan Clark, of Cambridge; Bradford Kingman, of North Bridgewater; and William H. Dall, of San Francisco, were elected Corresponding Members.

TUESDAY, AUGUST 28, 1866. Field Meeting at Salisbury Beach.

By invitation of the Amesbury and Salisbury Horticultural Society, a meeting was held at Salisbury Beach this day. The weather was admirably suited for an excursion of this character, and nearly four hundred persons from Salem and vicinity attended the meeting, the number being increased to upwards of two thousand, by persons interested from the northern portion of the county who arrived in vehicles of all description. Leaving the cars at the East Salisbury station, a walk or ride of from two to three miles brought the Salem party to the famous Salisbury Beach, which fronts the broad Atlantic, and affords a splendid drive-way of hard level road, for seven miles from the mouth of the Merrimac to Hampton River. The Beach is held by a Company of Commissioners, under a grant from the General Court made within ten years of the settlement of the country, and they leave suitable lots to parties who wish to build. There is now a Hotel and several houses, and the Beach Village is constantly increasing, and will eventually become a place of great celebrity, as the beach is hardly equalled along the whole coast in those qualities legitimately belonging to sea-side resorts.

After passing the forenoon in rambling about the beach and the woods in its vicinity, refreshments were partaken of in two private houses which were placed at the disposal of the Institute, the Beach people kindly providing a good chowder and other substantials.

At two o'clock the meeting was called to order in front of the residence of W. W. Huse, Esq., to whom the Institute are under obligations for many kind attentions during the day.

Vice President FOWLER in the chair.

After the reading of the records of the last meeting, letters were announced as received from:—

Capt. A. Hyatt, Boston Society of Nat. History (Aug. 6); Prof. D. S. Sheldon, Burlington, Iowa; Dr. A. Kellogg, San Francisco, Cal.; S. L. Boardman, Augusta, Me.; A. C. Goodell, Jr., Salem (Aug. 8); Prof. J. D. Dana, Yale College; Matthews and Robinson, Boston; Capt. N. E. Atwood, Provincetown; John Best, Utica, N. Y.; T. A. Cheney, Watkins, N. Y.; W. A. Smith, Worcester; W. C. Binney, Amesbury; A. H. Bullock, Worcester; Corporation of Harvard College; Trustees of Boston Public Library (Aug. 9); Prof. A. E. Verrill, Yale College; N. Vickary, Lynn (Aug. 10); J. H. Thomson, New Bedford (Aug. 11); C. A. Emery, Springfield; T. McIlwraith, Hamilton, C. W.; F. Poole, South Danvers (Aug. 13); Prof. D. S. Sheldon, Burlington, Iowa; Portland Society of Natural History (Aug. 14); H. A. Cutting, Lunenburg, Vt.; C. J. Maynard, Newtonville; Temple Prime, New York (Aug. 16); Dr. Wm. Sharswood, Philadelphia, Pa.; John G. Whittier, Amesbury (Aug. 20); Dr. E. W. Hubbard, Tottenville, N. Y.; R. E. C. Stearns, San Francisco, Cal.; American Antiquarian Society (Aug. 23); Frank Stratton, Natick; E. T. Cox, New Harmony, Ind.; B. O. Peirce, Boston; Prof. H. C. Wood, Philadelphia, Pa.; Edwin Bicknell, Boston; Charles Nauman, Lancaster, Pa.; W. W. T. Butterfield, Indianapolis, Ind. (Aug. 24); J. H. Hichcox, Albany, N. Y.; Joseph Blake, Gilmanton, N. H.; Dr. James R. Nichols, Haverhill; W. C. Binney, Amesbury (Aug. 27); John G. Whittier, Amesbury; New Hampshire Historical Society (Aug. 28).

Donations to the Museum and Library were announced.

F. W. Putnam, of Salem, reported upon the result of the zoölogical party. The collections were principally obtained during the walk from East Salisbury station to the Beach, and consisted of several insects, salamanders, &c. He then gave a brief outline of the natural history of the salamander, the mode of development, and the most prominent differences of this and the allied families of reptiles. Some oak galls, placed upon the table, suggested some appropriate and interesting remarks upon the species of insects that cause this peculiar growth.

G. D. Phippen spoke of the botanical collections, prominent among which were the *Liatris scariosa*, a beautiful flower, somewhat resembling, in its general appearance, a thistle, though not allied to that family.

Charles K. Stevens described the magnificent microscope which Mr. Huse kindly exhibited to the company.

W. C. Binney, Esq., of Amesbury, being called upon, expressed the gratification of the Amesbury and Salisbury Horticultural Society, in having this opportunity to welcome the Essex Institute and their friends to Salisbury Beach, and hoped that they would enjoy themselves and be amply compensated.

Dr. G. B. Loring, of Salem, recalled some of the incidents in the early history of this town, alluding to a session of the General Court being held here, in order to settle the boundary question between Massachusetts and New Hampshire; also to the famous "Essex Result" signed by a citizen of Sallsbury in the Revolutionary times, "Hon. Caleb Cushing," a name that has been prominent in our annals to the present day. He then alluded to this Meeting on the shore of the ocean, and gave a very graphic account of the scenes witnessed by a drop of water during its passage from the head of the Missouri, down the Mississippi, through the Gulf of Mexico and the Gulf Stream into the broad Atlantic, thence taken into the air by evaporation and borne along to the land, and then to perform another voyage of like character.

Dr. James R. Nichols, of Haverhill, gave a very interesting account of the "Chemistry of the Sea," stating that the excessive saline condition of the ocean is probably due to the existence of large bodies of salt in close proximity, or somewhere within reach of streams flowing into the ocean; and as chloride of sodium, or common salt, is one of the most abundant of all the soluble substances found on our earth, it consequently predominates in sea-water. But while it is the most abundant, and perhaps the most useful, it is by no means the only valuable substance carried into the sea. In quantity after salt come certain combinations of magnesia, next salts of lime, the carbonate held in solution by excess of carbonic acid, then small quantities of potash and oxide of iron, and, lastly, a trace of a most remarkable body, iodine. Dr. Nichols then gave an account of the manner in which iodine, soda, and potash are obtained from sea-plants, and showed how man was indebted to the Mollusks and the Polyps for lime and marble.

The remarks of Dr. Nichols were most instructive, and we call attention to his paper on this subject published in the *Boston Journal of Chemistry and Pharmacy*, of November 1, 1866, where the matter is treated in detail.

Major Moses Eaton, jr., of South Hampton, N. H., welcomed the Institute, in behalf of the Corporation, of which he was the presiding officer, and tendered the hospitalities of the place.

W. H. B. Currier, Esq. of Sallsbury, and editor of the "Villager," expressed a great interest in the Institute, and called attention to the importance of their meetings.

On motion of Mr. E. N. Walton the following vote was passed:—

Resolved, That the thanks of the Essex Institute be presented to the Officers and Members of the Amesbury and Sallsbury Horticultural Society, and to W. C. Binney, Esq., Hon. Benjamin Evans, Wm. H. B. Currier, Esq., W. W. Hues, Esq., of Amesbury and Sallsbury; to Major

Moses Eaton, jr., of South Hampton, President of the East Salisbury Plank Road Corporation; and to other friends who have contributed to the interest of our meeting to-day.

The meeting then adjourned to meet at the rooms of the Institute the next day at noon.

WEDNESDAY, AUGUST 29, 1866. Adjourned Meeting.

H. F. SHEPARD, Esq., in the chair.

Seabury F. Rogers and William Pousland, of Salem, were elected Resident Members.

FRIDAY, SEPTEMBER 14, 1866. Field Meeting at Gloucester.

The Field Meeting, so often prevented by unpropitious weather, was held at Gloucester this day. The attendance was quite large, about five hundred persons arriving by the cars, and many more by private conveyances. The morning was occupied in excursions in the pastures, woods, and on the sea-shore, in search of specimens; or in visits to various historical memorials. At noon a large party assembled at the Town Hall and partook of refreshments; the citizens kindly providing hot coffee, tea, and other luxuries.

The afternoon meeting was held at the Independent Christian Church, and was called to order soon after two o'clock.

Vice President GOODELL in the chair.

The reading of the records of the last meeting were omitted, and the Donations to the Library and Museum were announced.

Letters were announced from—

G. W. Peck, New York, N. Y.; Justin Hinds, Salem; Massachusetts Historical Society; Maine Historical Society; Iowa State Historical Society (Aug. 29); Dr. B. Pickman, Rye, N. H.; Dr. A. S. Packard, Brunswick, Me.; T. Apoleon Cheney, Watkins, N. Y.; C. A. Beckford, Gloucester; G. Peabody Russell, Salem (Aug. 31); W. F. Goodwin; New Hampshire Historical Society; Nantucket Athenæum (Sept. 1); Moses Strong, New Haven, Ct.; John Janes, Salem; Horace Mann, Cambridge; Capt. N. E. Atwood, Provincetown (Sept. 4); Edwin Bicknell, Boston (Sept. 5); E. S. Morse, Portland, Me.; E. Suffert, Havana, Cuba; A. B. Ashby, Newburyport; W. W. V. Rosa, Watertown, N. Y. (Sept. 6); Prof. J. Zingley, Allegheny College, Meadville, Pa.; C. A. Beckford, Gloucester (Sept. 8); Horace Mann, Cambridge; Prof. H. Allen, University of Pennsylvania; J. E. Chase, Holyoke; A. M. Edwards, New York, N. Y.; George F. Calef, York Institute, Saco, Me. (Sept. 9); Prof. S. F. Baird, Wood's Hole; The Numismatic and Antiquarian Society of Philadelphia; F. Haven, jr., Beverly Farms (Sept. 12); W. J. Beal, Union Springs, N. Y.; Capt. N. E. Atwood, Boston (Sept. 13).

The chair made a few remarks concerning the early settlement of

Cape Ann, and exhibited the original charter of the Colonists. This charter or original indenture was made the first day of January, 1623, between Lord Sheffield on the one part, and Robert Cushman and Edward Winslow, themselves and associates, on the other part, assigning land at Cape Ann for a fishing colony. J. Wingate Thornton, Esq., of Boston, who presented this valuable parchment document to the Institute some two or three years since, has ably shown in his work entitled "The Landing at Cape Ann," that Massachusetts begins her history not at Salem, nor under the patronage of the organization which obtained the charter of March, 1627-8, but in the spring of the year 1624, at Cape Ann, where the colony was established under the authority of this, her first charter,—and that Roger Conant, the leader of this settlement, was the first Governor.

Mr. Goodell also read a letter from Mr. Thornton, in which he says:—

"The labor of ROGER CONANT was, in its time, obscure, so is that of the architect; yet, if the latter be memorable in the grandeur of the Cathedral, should not the glory of this living temple, the Commonwealth, awaken veneration for Conant, who 'conceiving in his mind' the grand thought of a colony 'on account of religion,' and 'willing to begin' would 'not desert' it in the day of extremity, but as leader of the forlorn hope 'waited the Providence of God,' and succeeded as we now testify! What higher conception, what nobler origin, could we wish for our Commonwealth? And shall not truth and gratitude cherish the memory of him whose generous mind 'conceived,' and whose mighty Christian faith effectually opened the way for succeeding generations? Tracing back the historical links of the Commonwealth we find the first in the hands of Roger Conant. If the record be at all faded by time, it is our grateful duty to renew it."

Hon. John J. Babson, of Gloucester, was called on and made some interesting remarks concerning the history of the town. He thought it remarkable that over one hundred and twenty years should have elapsed after the discovery of America before any prominent point from Monhegan to Cape Cod should be discovered. It was one hundred and ten years after the voyage of Columbus before Cape Cod was discovered, and twelve years afterwards, Capt. John Smith, with eight men, coasting along the coast, discovered Cape Ann, and named it after a Turkish damsel who befriended him in his distress, Tragabigzanda. It seems strange that twelve years should have elapsed after Plymouth was discovered before they should have known anything of this excellent harbor just across the bay. It is not wonderful at that season, that they should have found Plymouth, but had they coasted around the bay at all, and discovered this harbor, so much better for all their purposes, they would have settled here. I do not doubt that the original settlement of the cape was the result of an accident. The

fishing company who were at first sent here for fishing only, afterwards combined fishing and agriculture. Two ships were sent; one put back, the other arrived at Monhegan. From there they came here, into our harbor undoubtedly; boats were sent out to our present fishing grounds; and secured a fare, when the ship went to Bilboa. She left here seven men, on Stage Fort, and these men were increased the next year by some ten or fifteen more. Cushman and Winslow, of the Plymouth colony went to England, secured a charter for this province, chartered a ship and came over to this locality. Whether the two companies united or not we cannot tell, — and it is not certain how this charter was regarded by either of the colonies.

The later history of the town is not important. There is every reason to believe that Gloucester was first settled by farmers. Salem was the first fishing town, afterwards followed by Marblehead, and subsequently Gloucester became a fishing mart, and now leads the world.

The people of the town suffered greatly during the revolutionary war. They depended on what they could draw from the water, which was entirely cut off, and they could not raise enough from the land to subsist the people, consequently many of the people were supported by charity.

Gen. H. K. Oliver, of Salem, inquired why the town was called Gloucester, saying that "cester" means camp, but he had not heard what "Glou" signified.

Mr. Babson answered, that from the best information received the town was named after the city of Gloucester, in England, from which place some of our early settlers came. Mr. Babson drew a parallel between the city of Gloucester, situated in the beautiful valley of the Severn, and our rock-bound coast. In regard to the etymology of the word he thought it was derived from the Welch word 'Gleaw,' the name of a chieftain, and the Latin word 'costra,' camp or fortification.

Mr. Goodell made some remarks concerning the origin of the name of Salisbury.

Mr. R. S. Rantoul read an interesting paper on Codfish in Massachusetts history, which was referred to the Publication Committee. (Printed in the Historical Collections, Vol. viii.)

Mr. F. W. Putnam spoke of the Codfish anatomically considered, and explained how it differed from the Mackerel, Cunner, and other fishes which he exhibited.

Capt. N. E. Atwood, of Provincetown, was introduced, and spoke of the different names and habits of fish. Many fishes of no marketable value are known by different names at various places.

We find the codfish extending over a larger geographical range

than many other species. In Europe every part of this fish is used: the sounds to make glue; the bones pounded up and fed to cattle.

On our coast the codfish differ in size; probably from their different ages. They are not a migratory fish, like mackerel, but are somewhere on our coast every month in the year. At Cape Cod we find them in shoal water, following the bait; as the weather gets warmer, we find them in deeper water. Before trawl-fishing was introduced into Massachusetts waters we caught but few haddock; we didn't suppose they were there, but when we used the trawl, we caught nearly all haddock. In dressing the fish we found mud and shells in the haddock, but none in the stomach of the cod, showing that the haddock lives nearer the bottom than the cod. The practice of trawling has not tended to decrease the supply of haddock, as was feared. The codfish lives to a considerable age, and the supply is almost inexhaustible.

Capt. Atwood also gave an interesting account of the habits of the mackerel. The earliest large mackerel are the spawning fish, and these will not bite until after they have deposited their spawn; they are often caught in nets, but will not take the hook. Later in the season other mackerel come in and take more readily to the hook. Mackerel grow to maturity in three or four years. The difference in the cull of mackerel denotes a year's growth. No two men acquainted with the matter would disagree on the cull of mackerel, the line of demarkation is so well defined.

The captain gave some interesting reminiscences of his experiences in taking mackerel, and a variety of information concerning the habits of this fish. In reply to an inquiry, he said that mackerel inhabited all depths of water.

Mr. Alpheus Hyatt gave an account of his morning researches among the piles under the wharves of the harbor; exhibiting portions of bark taken from the piles which were covered with the young, or hydroid state of Jelly-fishes, and described the development of these singular animals.

Mr. Edward S. Morse explained the structure of some fine Barnacles which had been collected in the harbor.

Rev. J. C. Fletcher, the celebrated Brazilian traveller, related several interesting incidents of his experience in foreign lands, showing how Essex County people are scattered over all the world, and attributed the Imperial reception of Agassiz in Brazil to the impression first made upon the mind of the Emperor by the discovery, by one of Agassiz's pupils from Essex county, of the singular habit of a Brazilian fish, belonging to the family of Chromids, which carries its eggs in the mouth until they are hatched.

Mr. C. M. Tracy gave some account of the red granite of Gloucester, and his remarks concluded the scientific discussions, at one of the largest and most interesting Field Meetings ever holden under the auspices of the Institute.

There were many gentlemen present at the meeting whom the audience would have gladly listened to had there been time; among them were John H. Shepard, Librarian New England Historic-Genalogical Society; Rev. J. L. Sibley, Librarian of Harvard University; Joel Munsell, Annalist of Albany; John Johnson, President of the York Institute, Saco, Me., and Richard Frothingham, the historian of Charlestown.

On motion of Gen. H. K. Oliver it was unanimously—

Resolved.—That the thanks of the Institute be given to Messrs. John J. Babson and Charles A. Beckford, of Gloucester, for the very useful and acceptable facilities afforded us in the general objects of our meeting; to Charles E. Glover, Esq., Town Clerk of Gloucester, for allowing us the use of the Town Hall for our collation; and to the Proprietors of the Church for the use thereof for the meeting of the Society.

The meeting adjourned to Sept. 15, at the rooms of the Institute.

SATURDAY, SEPTEMBER 15, 1866. Adjourned Meeting.

H. F. KING, Esq., in the chair.

Joseph Conant, of Hamilton, and Charles A. Estes, of Salem, were elected Resident Members.

MONDAY, SEPTEMBER 17, 1866. Regular Meeting.

Judge WATERS in the chair.

W. C. Binney, of Amesbury, and Jackson H. Sweet, of Haverhill, were elected Resident Members.

The Secretary announced the decease of our Corresponding Member, Dr. Gould, of Boston, and introduced the following resolutions, which were unanimously adopted.

The Essex Institute have learned with deep regret the sudden decease of a corresponding member, AUGUSTUS ADDISON GOULD, of Boston, whose life, apart from the active duties of his profession, has been mainly devoted to scientific research, and whose genius, industry, and patience have won for him an honored name among the most eminent Naturalists. Therefore—

Resolved.—That the members of the Essex Institute deeply deplore the loss of one whose career of life has been rendered brilliant by his many and valuable contributions to science, and whose vast attainments have placed him at the head of his chosen profession in this state, and whose genial and kindly disposition, and constancy of friendship have endeared him to a large circle of associates and friends.

Resolved, — That the Secretary be requested to transmit an authenticated copy of these resolves to the family of the deceased, and to tender to them our sympathy and condolence in their bereavement.

*Additions to the Museum and Library during July,
August, and September, 1866.*

TO THE NATURAL HISTORY DEPARTMENT.

BY DONATION.

BABCOCK, A. L., Sherborn. Skeleton of an Anteater, from Surinam.

BALCH, D. M., Salem. King Bird and a young Bittern, from Salem.

BARTLETT, JOHN, Haverhill. Collection of Shells, from the Merrimac River, and Ponds about Haverhill.

BROWN, CAPT. FRANCIS, Salem. Chimney Swallow, from Salem.

COLCORD, MRS. H. M., South Danvers. Two Birds, from South Danvers.

COLLINS, CHARLES H., Salem. Specimens of *Prionotus* and *Syngnathus*, from Salem Harbor.

COOKE, C., Salem. Intestinal Worms, from Seals and Porpoise. Parasites, from the gills of a Sturgeon. Collection of Beetles, from Manchester.

CROSBY, MRS. A., Salem. Nest of the Blue Yellow-backed Warbler, from West Bridgewater.

DOGGETT, MRS. K. M., Chicago, Ill. 44 species of named Plants, from the vicinity of Chicago.

DOWBRIDGE, ANDREW, JR., Salem. A large Eel, weighing seven pounds, and measuring four feet in length, from Cowler's Hole, Salem.

EMERTON, J. H., Salem. Lichens, from Hamilton. Collection of Insects, from vicinity of Salem. Collection of Insects, from the White Mountains.

FELT, S. Q., Salem. Fungus, from Salem.

GOLDSMITH, CAPT. JOHN, Salem. Nuts, from the West Coast of Africa.

HERSEY, CAPT. BENJ., Salem. Claws of a very large Lobster, taken in Salem Harbor.

HILL, B. D., JR. Fossils, from the Oil Region of Canada East.

HOTCHKISS, MISS SUSAN V., New Haven, Ct. *Astacus*, from Lake Regis, N. Y.

HYATT, ALPHEUS, Salem. Collection of Bryozoa and Hydroids, from Gloucester. Collection of several species of Polyzoa, from Wenuchus Lake, Lynn.

KIMBALL, ELBRIDGE, Wenham. Specimen of a species of *Mygale*, from Wenham.

KIMBALL, MISS MARY, Salem. A large Beetle, from Roanoke Island.

KING, CAPT. H. F., Salem. Specimen Nest of a Mud Wasp, from Salem.

KING, MISS H. M., Salem. Specimen of a Moth, from Salem.

KINGSMAN, NATH'L, and OSGOOD, CAPT. CHARLES, Salem. Male and Female Seals, from Ipswich River, Mass.

LEE, R. G., Salem. A Sea Worm, from the Atlantic Ocean.

MCCAFFERY, WM. H., Saratoga, N. Y. Specimen of the Rock formed at High Rock Spring, and containing recent animals and plants in a fossil condition.

ORNE, ALFRED, and others, of Salem. A large Sturgeon, taken at New Mills, Danvers.

PEABODY, ALFRED S., Salem. A valuable collection of Skins of Birds and Mammals; Reptiles in alcohol; dried Plants, Shells, and other specimens, from about Cape Town, Africa.

PERKINS, T. L., Salem. Embryos of the Dog-fish and a collection of Insects, from Rockport.

PHIPPEN, MRS. M. C., Salem. A collection of Insects, Shells, Coral, and other specimens, from Africa.

PICKMAN, H. D., Salem. Skin of a Loon, from Richardson Lake, Me.

POOR, ALFRED, Salem. 33 specimens of 2 species of Wood-boring Beetles.

PORTER, FREDERIC, Salem. A fine specimen of the Dodder, from Salem.

POTTER, DANIEL, Salem. Specimen of the Little Brown Bat, from Salem.

PULSIFER, CHARLES, Salem. Specimen of *Prionotus*, from Salem Harbor.

PUTNAM, MRS. EBEN, Salem. Mineral, from Chill.

PUTNAM, F. W., Salem. Collection of Essex County Crustaceans and Insects.

PUTNAM, MRS. W. H. A., Salem. 13 species, 41 specimens of Shells, from Caldera, Chill.

SCOTT, A. D., Salem. Specimen of *Sphinx* sp., from Salem.

SEARS, JOHN H., Danvers. A collection of the Nest and Eggs of several species of Essex County Birds. Several rare Insects, from Danvers.

SHELDON, PROF. D. S., Davenport, Iowa. A large and very valuable collection of named Shells and Plants, principally from the West-

ern States and the Rocky Mountains, and a collection of Austrian Plants.

SMITH, F. A., Salem. Specimen of a *Mantis*, from Texas.

SYMONDS, SAMUEL, Salem. A very large Fungus, from North Salem.

TOWNE, CHARLES, Salem. Head of a Puffing Pig, taken off Swamp-scott.

TRASK, AMOS, Danvers. Nest of a Chimney Swift, from Danvers.

TUTTLE, MRS. F. W., Salem. Specimen of Coral, from the Sandwich Islands.

UPTON, CAPT. JOSEPH, Salem. A valuable collection of Reptiles, Insects, Crustaceans, and Mollusks, from Sierra Leone, West Coast of Africa, and from the West Indies. Sponge, from Beverly Harbor.

WEAVER, COMMANDER A. W., U. S. Navy. 2 Living Goats, from the West Coast of Africa.

WEBB, BENJ., JR., Salem. Specimen of the Brown Bat, from Salem.

WEST, WM. S., Salem. A collection of Insects, from Salem.

WHEATLAND, DR. H., Salem. Parasites, from the gills of a Cod.

WILLIAMS, H. L., Salem. A large Eel, from Cowler's Hole, Salem. Specimen of Talc, from Canada.

WYMAN, HUMPHREY, Canada East. Fossils, from the Silurian of Canada West.

YALE COLLEGE, CABINET OF, New Haven, Ct. A collection of Echinoderms, Star-fishes, Ophiurians, Corals, and Mollusks, from the West Indies and Panama.

TO THE HISTORICAL DEPARTMENT.

BY DONATION.

ABBOTT, JOHN, Beverly. Leaves from the Charter Oak.

ALLANSON, LT. J. S., Marblehead. Several Relics of the late war.

CARPENTER, J. S., Salem. \$700 of Confederate Notes.

CONGDON, MISS EUNICE, New Bedford. Revolutionary Relics, and Relics of the late war, from Virginia.

DENSLow, W. W., New York. Revolutionary Relics, from Washington Heights.

FOOTE, CALKB, Salem. \$10 Confederate Note.

FOOTE, REV. H. W., Boston. 13 Plaster Medallions; Seeds and Leaves, from various Historical places.

GRANT, FRANKLIN, Salem. Relics of the late war.

GOLDTHWAITE, J. A., Salem. A collection of North Carolina Paper Currency.

LOVETT, EDMUNDS, Beverly. 8 Native Swords, from the West Coast of Africa.

- PITMAN, CAPT. —**, Salem. A Palmetto Flag.
SHORT, JOSEPH, Salem. Relics from the Battlefield of Gettysburg.
TENNEY, GORHAM D., Georgetown. Indian Arrow-head, from Georgetown.
WEBB, BENJAMIN, JR., Salem. Chinese Toy.
WILLIAMS, W. A., Salem. A number of Indian Implements, found in an Indian Grave on Winter Island, Salem.

TO THE LIBRARY.

BY DONATION.

ALLEY, JOHN B. Report of Committee on Reconstruction, 1 vol. 8vo. Coast Survey Charts, 31, 32, 33. Monthly Report of Department of Agriculture for June, 1866. United States Eighth Census, 1860 (Manufactures), 1 vol. 4to. United States Eighth Census, 1860 (Agriculture), 1 vol. 4to. Congressional Globe, First Session Thirty-eighth Congress, 1863-64, 4 vols. 4to. Congressional Globe, Second Session Thirty-eighth Congress, 1864-65, 2 vols. 4to.

ARCHER, MRS. FIDELIA W. 668 Pamphlets, 266 Serials, 446 bound volumes, as follows:—Peirce's History of Harvard University, 8vo, Cambridge, 1833. Hodge's History of Presbyterian Church, 2 vols. 8vo, Philadelphia, 1839. Hall's Account of a Voyage of Discovery West Coast of Corea, 8vo, Philadelphia, 1818. Burgh's Dignity of Human Nature, 8vo, New York, 1812. Bradley's Sermons, 8vo, Philadelphia, 1822. Upham's Jahn's Biblical Archaeology, 8vo, Andover, 1823. Saurin's Sermons (Robinson), 5 vols. 8vo, London, 1796. Fleetwood's Life of Christ, 2 vols. 8vo, Carlisle, 1792. Macknight's Apostolical Epistles, 6 vols. 8vo, Boston, 1810. Webster's Discourse at Plymouth, Dec. 22, 1820, 8vo, Boston, 1825. West's Essay on Moral Agency, 8vo, Salem, 1794. Thoughts on Domestic Education, 8vo, Boston, 1829. Missionary Herald and Panoplist, bound in 41 vols. National Preacher, bound in 12 vols. 8vo. Congregational Quarterly, from 1859 to 1866, 27 numbers. Theological Review, 1834 to 1839, 6 vols. 8vo, New York. Assembly's Magazine, 2 vols. 8vo, Philadelphia, 1806. Evangelical Intelligencer, 3 vols. 8vo, Philadelphia, 1807. Christian's Magazine, 2 vols., New York, 1806. Rail Road Returns of Massachusetts, 1864, 1865, 2 vols. 8vo, Boston. Massachusetts Board of Education, 25th and 28th Annual Report, 2 vols. 8vo, Boston. Journal of Valuation Committee of Massachusetts, 1860, 8vo, Boston. Insane and Idiots of Massachusetts, 1854, 8vo, Boston. Journal of Massachusetts House of Representatives, 1865, 8vo, Boston. Agriculture of Massachusetts, 1865-66, 8vo, Boston. Compendium of U. S. Census, 1850, 8vo, Washington. Abstract of Seventh Census of U. S., 8vo, Washington. Pope's Poetical Works (Warburton's Notes),

PROCEEDINGS ESSEX INST., VOL. V.

10

MAY, 1867.

3 vols. 12mo, Philadelphia, 1819. *Richmond's Domestic Portraiture*, 12mo, New York, 1833. *Constitution of U. S. of America* (Jefferson's Manual), 16mo, Washington, 1828. *Memoir of Rev. W. Tennant*, 18mo, Springfield, 1822. *Life of Rev. Richard Baxter*, 16mo, New York. *Knapp's Lukas*, 16mo, Bombay, 1848. *Porter's Puritans and Jesuits*, 12mo, New York, 1851. *Russell's Lessons in Enunciation*, 16mo, Boston, 1830. *Flavel's Keeping the Heart*, 16mo, Boston, 1813. *Principles of Politeness*, 16mo, Dover, 1814. *The Pastor at the Sick-bed*, 12mo, Philadelphia, 1836. *Biblia Sagrada*, 12mo, New York, 1848. *Bailey's Ovid*, 8vo, London, 1756. *Bigland's Letters on Ancient and Modern History*, 8vo, Philadelphia, 1806. *Life of Cotton Mather* (title-page wanting) 8vo. *Collections of the Am. Statistical Association*, vol. 1, 8vo, Boston, 1847. *Memoir of Rev. Samuel Pearce*, 16mo, New York. *Cowper's Poems* (Imp.). *Barnes's Inquiry into the Scripture View of Slavery*, 12mo, Philadelphia, 1846. *Adams's Truth of Religion*, 12mo, Boston, 1804. *Paley's Natural Theology*, 16mo, New York, 1820. *Newman's Rhetoric*, 12mo, Portland, 1827. *Krummacher's Cornelius the Centurion*, 12mo, New York, 1841. *Gisborne's Poems — Sacred and Moral*, 12mo, London, 1818. *Valley of the Mississippi*, 12mo, Philadelphia, 1834. *James's Christian Charity*, 12mo, New York, 1829. *Owen's Forgiveness of Sin*, 12mo, New York. *Nott's Miscellaneous Works*, 8vo, Schenectady, 1810. *Chalmers's Sermons*, 8vo, New York, 1819. *Chalmers's Discourses on the Christian Revelations*, 8vo, Andover, 1818. *Butterworth's Concordance to the Holy Scriptures*, 8vo, Boston, 1828. *Abbott's Young Christian*, New York. *Quarterly Register*, 8 vols. 8vo. Pamphlets, bound, 18 vols. 8vo. *Orations, Sermons, etc.*, 22 vols. 8vo. *Plymouth Collection of Hymns*, 8vo, New York, 1855. *Church Music*, 12mo, Rochester, 1855. *Watts's Psalms of David*, 12mo, Boston, 1803. *Hedge and Huntington's Hymns for the Church of Christ*, 12mo, Boston, 1859. *Church Psalmody*, 16mo, Boston, 1831. *Methodist Hymns*, 16mo, New York, 1856. *Psalms and Hymns*, 16mo, Boston, 1845. *Allen's Psalms and Hymns*, 12mo, Boston, 1835. *Worcester's Christian Psalmody*, 16mo, Boston, 1821. *Montgomery's Christian Psalmist*, 16mo, Glasgow, 1829. *Stow and Smith's Psalmist*, Boston. *Milman's History of the Jews*, 3 vols. 16mo, New York, 1834. *Abercrombie's Philosophy of Moral Feelings*, 16mo, New York, 1834. *Thatcher's Lives of the Indians*, 2 vols. 16mo, New York, 1832. *Backus's Regeneration*, 16mo, Boston, 1839. *Edwards's Revival of Religion in New England*, 16mo, Northampton, 1819. *Gallaudet's History of Joseph*, 16mo, New York. *Bush's Notes on Genesis*, 2 vols. 12mo, Andover, 1840. *Tholuck's Commentary on Gospel of St. John*, 12mo, Boston, 1836. *Woods's Lectures on Infant Baptism*, 12mo, Andover, 1828. *Woodward's Pious Selection*, 12mo, Philadelphia, 1815.

Cummings's Congregational Dictionary, 12mo, Boston, 1852. Cooke's History of German Anabaptism, 16mo, Boston, 1845. Cooke's Century of Puritanism, 12mo, Boston, 1855. McGill's Discourses, 12mo, Montreal, 1858. Taylor's Lectures on Spiritual Christianity, 12mo, New York, 1841. Banvard's Revival Gems, 16mo, Boston, 1858. Burder's Village Sermons, 2 vols. 12mo, Philadelphia, 1814. M'Culloch's Popery Condemned, 2 vols. 12mo, Edinburgh, 1808. Religious Dissensions, Cause and Cure, 12mo, New York, 1838. Bigg's Redeemer's Speedy Personal Return, etc., 12mo, New York, 1842. Cotton's Keys of Heaven, 12mo, Boston, 1848. Whitman's Two Letters to M. Stuart, 8vo, Boston, 1831. Fuller's Dialogues, Letters, and Essays, 12mo, Hartford, 1810. Bush's Notes on Judges and Joshua, 12mo, New York, 1838. First Ten Years of American Tract Society, 16mo, Boston, 1824. Christian Education, 16mo, New York. Booth's Treatise on the Divinity of Christ, Burlington, 1802. Janeway's Letters on Abrahamic Covenant, 16mo, Philadelphia, 1812. Woods's Native Depravity, 12mo, Boston, 1885. Chalmers's Discourses, 12mo, Hartford, 1821. Foster's Essays, 16mo, Hartford, 1807. Worcester's Last Thoughts on Important Subjects, Cambridge, 1838. Cooke's Universalism Exposed, Lowell, 1884. Hill's Mature Reflections, etc., 16mo, New York, 1836. Willard's Rhetoric, 16mo, Boston, 1830. Cardell's Essay on Language, 16mo, New York, 1825. Grant's Intellectual Education, 16mo, Baltimore, 1813. Evans's History of all Christian Sects, 12mo, New York, 1844. Huntington's Sermons, 16mo, Boston, 1767. Worcester's Causes and Evils of Contentions, 12mo, Boston, 1831. Brownlee's History of the Jews, 12mo, New York, 1842. Hague's Guide to the Study of Moral Evidence, Boston, 1834. Ambrose's Looking unto Jesus, Glasgow, 1772. Hooght's Hebrew Bible, 8vo, New York, 1815. Flavell's Method of Grace, 8vo, New York. Simmons's Scripture Manual, 12mo, Boston. Memoirs of Missionaries, 12mo, Boston, 1833. Finney's Revivals of Religion, 12mo, New York, 1835. James's Family Monitor, 12mo, Boston, 1829. Blagden's Lecture on Hope, 12mo, Boston, 1854. Abbott's Young Christian, 12mo, New York. Edwards's Treatise on the Religious Affections, 16mo, New York. McEwen's Grace and Truth, 16mo, Boston, 1796. Stuart's Cicero on the Immortality of the Soul, 16mo, Andover, 1833. Brooks's Mute Christian, 16mo, Boston, 1841. Fuller and Wayland on Slavery, 16mo, New York, 1845. Sermons on the Atonement, 12mo, New York, 1811. Sermons by Huntington, Barnard, and others, 12mo. Confession of Faith, etc., Old South Church, 1841, 1855, 12mo, Boston, 1841. Davidson's Connexion of Sacred and Profane History, 3 vols., New York, 1845. Ely's Contrast between Calvinism and Hopkinsonianism, 8vo, New York, 1811. Winslow's Hints on Missions to India,

16mo, New York, 1856. Jay's American Colonization and Anti-slavery Societies, 12mo, New York, 1835. Green's Domestic and Foreign Missions, 12mo, 1838. Greenwood's The Child and the Man, 12mo, Boston, 1855. Goodrich's Ecclesiastical Class Book, 16mo, New York, 1839. Erskine's Freeness of the Gospel, 16mo, Boston, 1828. Harris's Mammon, 16mo, Boston, 1837. Worcester's Sermons, Practical and Doctrinal, 8vo, Salem, 1823. Humphrey's Discourses and Reviews, 12mo, Amherst, 1834. Adams's Roman Antiquities, 8vo, N. York, 1819. Hopkins's System of Doctrines in Divine Revelation, 2 vols. 8vo, Boston, 1798. Smith's Universalism Examined, etc., 12mo, Boston, 1842. Fuller's Calvinistic and Socinian Systems, 12mo, Boston, 1815. Lang's Religion and Education in America, 12mo, London, 1840. Berridge's Christian World Unmasked, 12mo, Boston, 1822. Baldwin's Baptism of Believers only, 12mo, Boston, 1806. Edwards's Critical Remarks on Jenkins's Defence of Baptists, Boston, 1803. Conference on Missions, 1860, at Liverpool, 8vo, London, 1860. Calendar of McGill University, 1862-63, 8vo, London, 1862. The Power of Religion, 12mo, New Bedford, 1799. Foster's Essay on Evils of Popular Ignorance, 12mo, Boston, 1821. Wilberforce's Justification and Regeneration, 12mo, Amherst, 1830. Peters's Sprinkling the only Mode of Baptism, 12mo, Albany, 1848. Watts's World to Come, 2 vols. 8vo, 1811. Treatise on Trigonometry, 8vo, Cambridge, N. E., 1820. Porter's Biblical Reader, 12mo, Andover, 1834. Humphrey's Revival Conversations, 16mo, Boston, 1844. Plumer's Thoughts on Religious Education, 16mo, New York, 1836. D'Argenson's Essays, 16mo, Worcester, 1797. American Congregational Year Book, 1856, 8vo, New York, 1856. First Ten Annual Reports of A. B. C. For. Missions, 8vo, Boston, 1834. Essays on Slavery, 8vo, Amherst, 1836. Barber's Elocutionist, 12mo, New Haven, 1839. Ryland's Life and Death of Andrew Fuller, Charlestown, 1818. Noehden's German Grammar, 12mo, London, 1818. Maury's Principles of Eloquence, 16mo, New York, 1807. Gould's Adams's Latin Grammar, 12mo, Northampton, 1846. Art of Speaking, Boston, 1795. Webster's Improved English Grammar, 16mo, New Haven, 1833. Barber's Grammar of Elocution, 12mo, New Haven, 1830. Irving's Elements of English Composition, 12mo, Georgetown, 1825. Burton's Helps to Education, 12mo, Boston, 1863. Upham's Elements of Intellectual Philosophy, 8vo, Portland, 1828. Stuart's Grammar of Hebrew Language, 8vo, Andover, 1838. Paley's Principles of Philosophy, 8vo, Boston, 1795. Stewart's Elements of Philosophy of the Human Mind, Brattleborough, 1808. Barber's Treatise on Gesture, 12mo, Cambridge, 1831. Wamostrocht's French Grammar, 12mo, Boston, 1821. Russell's Rudiments of Gesture, 12mo, Boston, 1830. Oldbug's Puritan, 2 vols. 12mo, Bos-

ton, 1836. Doctrinal Tracts, 2 vols. 12mo, Boston. Doctrinal Tracts, 2 vols. 12mo, 1842. Reese's Letters to Hon. William Jay, 12mo, New York, 1835. Roberts's Memoir of H. Moore, 2 vols. 12mo, New York, 1834. Storrs's Memoir of Samuel Green, 12mo, Boston, 1836. Memoir of Mrs. Judson. Unitarian Tracts, 3 vols. 12mo, Boston, 1828. Rhysical Effects of Alcoholic Drinks, 12mo, Boston, 1848. Temperance Documents, vol. 1, 8vo, Boston, 1835. Cotton Manufacture, 12mo, Boston, 1863. Beecher's Six Sermons on Intemperance, Boston, 1827. Walker's Elements of Elocution, 12mo, Philadelphia, 1811. Locke's Treatise on the Understanding, Boston, 1828. Flavel's Keeping the Heart, 16mo, New York. Foster's Appeal to the Young, 16mo, New York. Flavel's Touchstone of Sincerity, 16mo, New York. Gurney's Sabbath, 16mo, Andover, 1833. Mason's Student and Pastor, 16mo, Exeter, 1794. Willison's Meditations, etc., 16mo, Newport, 1794. Campbell's Christian Preacher's Companion, Bethany, 1836. Muir's Cross and Crown, Paisley, 1769. Alexander's Revival and Its Lessons, 16mo, New York, 1859. Backus's Regeneration, 16mo, Hartford, 1800. Proudfoot's Parables, 16mo, Salem, 1820. Narrative of the Lord's Dealings with George Müller, 2 vols. 12mo, London, 1855. Fenelon's Education of Daughters, 16mo, Boston, 1820. Stuart's Hebrew Grammar, 8vo, Andover, 1821. Massillon's Sermons, Hartford, 1805. Course of Man, St. Louis, 1852. Edwards's Affections, 16mo, New York. Erskine's Remarks on the Internal Evidence, 16mo, Andover, 1823. Hodge's Way of Life, 12mo, Philadelphia. Barnes's Manual of Prayer, 16mo, Philadelphia, 1838. Edwards's Prayer, 16mo, Boston, 1747. Rush's Charges, 16mo, Lenox, 1829. Taylor's Holy Living and Dying, 12mo, Amherst, 1831. Abercrombie's Christian Character, 16mo, New York, 1839. Tyler's Memoir of Rev. Asahel Nettleton, 12mo, Hartford, 1845. Goldsmith's Essays and Poems, 16mo, Salem, 1804. Cowper's Task, 16mo, Boston, 1791. Marvin's History of Lake George, 16mo, New York, 1853. Essays by Cowley and Shenstone, 16mo, Boston, 1820. Campbell's Poetical Works, 16mo, Philadelphia. Cushing's Rules of Proceeding and Debate, 16mo, Boston, 1845. Eckard's Ten years in Ceylon, 16mo, Philadelphia, 1844. American Statistical Annual for 1854, 12mo, New York, 1854. Priestley's System of Biography. 8vo, Philadelphia, 1803. Cogswell's New Hampshire Repository, 8vo, Gilmanton, 1846. White's Early History of New England, 8vo, Concord, 1842. Hovey's Letters from the West Indies, 12mo, New York, 1838. Northern Traveller, 16mo, New York, 1825. Williams's Northern and Eastern Traveller's Guide, 16mo, N. Y., 1860. Adams's History of the Jews, 2 vols. 12mo, Boston, 1812. Goodrich's History of the U. States, 12mo, Boston, 1845. Newhall's Essex Memorial for 1836, 16mo, Salem, 1836. Ward's Simple Cobbler of Agawam, 12mo, Boston, 1843. Mof-

fat's Missionary Labors and Scenes, 12mo, New York, 1843. Smith's History of Evangelical Missions, 12mo, Hartford, 1844. Tytler's Elements of General History, 8vo, New York, 1817. Memoir of Thomas Boston, 8vo, Edinburgh, 1776. Memoir of General Lafayette, 12mo. Scott's Life of Thomas Scott, 12mo, Boston, 1822. Downing's Remains of J. W. Downing, 12mo, New York, 1841. Carey's Memoir of W. Carey, 16mo, Hartford, 1837. Cummings's Memoir of E. Payson, 16mo, New York. Cecil's Life of John Newton, 16mo, New York. Orton's Memoir of Dr. Doddridge, 16mo, Boston, 1828. Gregory's Memoir of J. Mason Good, 12mo, Boston, 1829. Hooker's Memoir of Mrs. S. L. Smith, 12mo, Boston, 1844. Hill's Life and Writings of Hugh Blair, 8vo, Philadelphia, 1808. Morell's Abridgment of Ainsworth's Dictionary, 8vo, Philadelphia, 1818. Pickering's Vocabulary, 8vo, Boston, 1816. Johnson and Walker's Dictionary, 8vo, Boston, 1828. The Panoplist, 1850, 1851, 8vo. Biblical Repertory, 10 vols. 8vo. Christian's Library, 3 vols. 8vo. Massachusetts Missionary Magazine, 2 vols. 8vo. The Sprite, Amherst.

BALLOU, RUSSELL A., Boston. Prayers and Hymns for the Church and Home, 1 vol. 16mo.

BROWN, GEORGE F. Hitchcock's Supplement to the Ichnology of New England, 1 vol. 4to.

CHASE, GEORGE C. Friend's Review, 13 nos.

DEVEREUX; HUMPHREY. Boston Semi-weekly Advertiser, 2 vols. folio, 1864-65. Christian Register for 1864, 1865, 2 vols. folio.

DROWNE, CHARLES, of Troy, New York. Annual Register of the Rensselaer Polytechnic Institute, 8vo, pamphlet.

EDMUNDS, J. M., Commissioner of General Land Office. Eighth Census of United States, 1860, Mortality and Miscellaneous Statistics, 1 vol. 4to.

GREEN, SAMUEL A., Boston. Pamphlets, 108. Boston Board of Trade, Reports of, 7 vols. 8vo. Boston Municipal Register for July, 1866, 8vo. Boston School Committee Reports, 1865, 1 vol. 8vo. Brooklyn Directory for several Years, 9 vols. 8vo. Boston Auditor's Report, 1865-66, 1 vol. 8vo.

HOTCHKISS, SUSAN V., New Haven. Yale Courant, vol. 1, no. 26. Programme of Wooden Spoon Presentation, etc.

HUNTINGTON, MRS. GEORGE, of Kelley's Island, Ohio. Sandusky City Directory, 1 vol. 12mo.

JOCELYN, MARY E. The Spirit of Missions, 8vo, 1865.

LAWRENCE, CHARLES, Danvers. Horticultural Register, vols. 1 and 2, 8vo. Loudon's Encyclopædia of Agriculture, 1 vol. 8vo.

LOGAN, THOMAS M., Sacramento, Cal. Logan's Report of Medical Topography, etc., and Epidemics of California, 8vo, pamph., 1865.

- LORD, N. J.** *Boston Daily Post*, April, May, June.
- MANN, HORACE**, of Cambridge. *Revision of the Genus Schiedea and of the Hawaiian Rutaceæ*, 8vo, pamph.
- NICHOLS, C. F.** *Jones's New Biographical Dictionary*, 1 vol. 16mo.
- NICHOLS, JAMES R.**, Haverhill. *Boston Journal of Chemistry and Pharmacy*, July, 1866.
- NICHOLS, JOHN H.** Pamphlets, 75. *Salem Gazette*, for 1812, 1 vol. folio.
- NORTHEND, W. D.** *Report on Commercial Relations of United States of America*, 1 vol. 4to, Washington, 1856.
- PAINE, NATHANIEL**, of Worcester. *Remarks on Early Paper Currency of Massachusetts*, 8vo, pamph.
- PALFRAY, CHARLES W.** *Philadelphia Enquirer*, 1861 to Aug., 1866.
- PARISH, ARIEL**, of New Haven. *Report of Board of Education of New Haven*, 8vo, pamph.
- PERLEY, JONATHAN.** *Stone's Memoir of James Milnor*, 1 vol. 8vo. *Massachusetts Register* for 1862, 1 vol. 8vo.
- PUTNAM, HANNAH P.** *American Almanac*, 6 vols. 12mo. *Massachusetts Register*, 19 vols. 16mo. *Miscellaneous Pamphlets*, 70.
- PUTNAM, MARY.** *The Independent*, Nos. 98 to 150 inclusive.
- SHEPPARD, JOHN H.**, Boston. *Ward's Magnet in Heavenly Attractions*, 8vo, pamphlet.
- SMITH, ELI A.**, Boston. *Catalogues of Tuft's College*, 1864-65, 1865-66, 8vo, pamphlets.
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MONDAY, OCTOBER 15, 1866. Regular Meeting.

Mr. BENJAMIN WEBB, jr., in the chair.

Letters were announced from Henry d'Alligny, Houghton, Mich (Sept. 12); Capt. N. E. Atwood, Boston (Sept. 15); H. Ware, Private Secretary to Gov. Bullock, Boston; Boston Society of Natural History; E. T. Cox, New Harmony, Ind.; Dr. William A. Nason, Chicago, Ill.; Robert Howell, Nichols, N. Y. (Sept. 17); Prof. A. E. Verrill, Yale College; A. L. Babcock, Sherborn; Edwin Bicknell, Boston (Sept. 19); B. O. Peirce, Boston (Sept. 20); W. V. V. Rosa, Watertown, N. Y. (Sept. 22); Prof. A. E. Verrill, Yale College (Sept. 23); L. Trouvelot, Medford, Mass. (Sept. 24); Dr. Samuel A. Green, Boston; W. G. Richardson, Oxford, Miss.; J. H. Stickney, Baltimore

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(Sept. 25); L. W. Crossman, Indianapolis, Ind. (Sept. 26); Smithsonian Institution (Sept. 27); J. F. Richardson, Gilead, Me.; William Pike & Co., Sterling, Ct.; Prof. F. J. Bumstead, New York; Prof. H. C. Wood, Jr., Philadelphia (Sept. 28); Rev. E. C. Bolles, Portland, Me.; Iowa Historical Society, Iowa City (Sept. 29); W. W. Denslow, New York (Sept. 30); Prof. Theodore Gill, Washington, D. C.; A. M. Edwards, New York; Dr. B. G. Wilder, Boston; G. F. Matthew, St. John, N. B. (Oct. 1); Prof. A. E. Verrill, Yale College (Oct. 2); Thomas Stewardson, Cor. Sec., Philadelphia Acad. Nat. Sciences; Rev. A. B. Kendig, Davenport, Iowa (Oct. 3); Rev. E. R. Beadle, Philadelphia; Dr. J. W. Robbins, Uxbridge, Mass.; Dr. A. S. Packard, Jr., Brunswick, Me. (Oct. 8); W. W. Denslow, New York; Dr. S. A. Green, Boston (Oct. 9); Dr. B. G. Wilder, Boston; A. M. Edwards, New York; Prof. Theodore Gill, Washington, D. C. (Oct. 11); Rev. E. R. Beadle, Philadelphia (Oct. 12); J. H. Thomson, New Bedford; Prof. A. E. Verrill, Yale College (Oct. 15).

Donations to the Library and Museum were announced.

Dr. Nathan R. Morse and Charles R. Brown, of Salem, were elected Resident Members.

MONDAY, NOVEMBER, 5, 1866. Regular Meeting.
Vice President GOODELL in the chair.

Letters were read from W. R. Scott, Buffalo Historical Society (Oct. 13); Dr. Henry Bryant, Boston (Oct. 17); John K. Rogers, Boston; C. J. Maynard, Newtonville (Oct. 18); Horace Mann, Cambridge; G. K. Gilbert, Rochester, N. Y. (Oct. 19); Prof. H. C. Wood, Jr., Philadelphia (Oct. 21); R. E. C. Stearns, San Francisco, Cal.; Dr. Henry Bryant, Boston (Oct. 22); William Clogston, Springfield (Oct. 23); B. F. Browne, Salem (Oct. 24); William S. Vaux, Philadelphia; Prof. A. E. Verrill, Yale College (Oct. 25); Rev. William O. White, Keene, N. H. (Oct. 27); Rev. E. C. Bolles, Portland (Oct. 29); Prof. W. H. Brewer, Yale College (Oct. 30); J. S. E. Rogers, Gloucester (Nov. 1); A. M. Edwards, New York; G. E. Baldwin, South Boston; Prof. S. F. Baird, Smithsonian Institution (Nov. 2); Anson Allen, Orono, Me. (Nov. 3).

The Superintendent read a letter from Mr. E. T. Cox, of New Harmony, Ind., in which he asked for information regarding the development of the fresh-water Snails, and, alluding to the fact that the Limnææ were observed to rise to the surface of the water by enclosing a bubble of air under their mantles, suggested the possibility of the Nautilus employing a similar mode in ascending to the surface. Mr. Cox also stated that he had living in an aquarium a *Siren lacertina*, which, when captured a year ago, was without the end of its tail. This deficiency was now nearly restored by a new growth.

Mr. Putnam made a few remarks on the power possessed by the class of Batrachians, which comprises all the scaleless reptiles, as the Frogs, Toads, Salamanders, and Sirens, by which they are able, by a

new and gradual growth of various parts, to reproduce organs that may have been amputated or injured. He then called on Mr. Morse for information regarding the Mollusks, in answer to the inquiries and suggestions of Mr. Cox.

Mr. Edward S. Morse stated that many of the fresh-water Snails had the power of rising and falling in the water, by increasing or diminishing their specific gravity, and that this was done by allowing a portion of air enclosed in the animal to expand or contract, and that the Pearly Nautilus was supposed to make use of the closed chambers of the shell for similar purposes; but later investigations had shown that this function was not enjoyed by the Nautilus. Mr. Morse then illustrated on the black-board the structure of the fresh-water Snails, and their development from the egg. He also mentioned their peculiar habit of crawling on the under surface of the water, and the opportunity offered to any one of examining their habits, since our brooks and ditches abound with them, and they can be easily kept in confinement. Mr. Morse also made a few remarks on the Pearly and Paper Nautilus.

A letter was read from Rev. A. B. Kendig, of Davenport, Iowa, who wished for information regarding the cause of the formation of ice in a cave in Decorah, Iowa. This cave is "a mere fissure in the rock, extending in depth from one hundred and fifty to two hundred feet. In this fissure ice forms in summer and disappears in winter. The ice is first found about thirty feet from the entrance, and increases as you advance. The cave was visited on the 14th of September last, and hundreds of pounds of ice was found."

Mr. Edwin Bicknell accounted for the occurrence of ice in the cave at that time by the theory of the evaporation of moisture. It is a well-known principle in physical science that the conversion of a fluid to the gaseous form is accomplished at a great expenditure of heat, and this, he thought, taken in connection with the naturally low temperature of the earth at that time, would account for the formation of the ice in summer.

In regard to the disappearance of the ice in winter, the same theory would hold good; the absence of evaporation in a great measure in cold weather, and the temperature of the earth being at that depth always above the freezing point. In support of the above theory he cited the well-known fact in geology that the temperature of the earth does not undergo any perceptible change in summer or winter, at a depth of from about twenty to one hundred feet from the surface, depending greatly on the latitude of the place in question. He also cited the known effects of the sudden sensation of cold produced by the evaporation of alcohol, or, still better, sulphuric ether, in contact

with the human body; and that the same principle is taken advantage of in producing local Anæsthesia by the use of Rhigoline in freezing the portion of the body to be operated upon. Mr. Bicknell farther cited the sudden fall of the mercury in the wet-bulb thermometer, on wetting the bulb to determine the dew-point, which effect is produced by the evaporation of the moisture from the bulb.

The Rev. E. S. Atwood made a few remarks on the uses in the East of earthen jars with a small mouth, for the purpose of keeping water cool, and of the formation of ice on the outside of the jars consequent upon the evaporation of the water.

Mr. Hyatt made some remarks confirming Mr. Bicknell's theory, and alluded to the temperature in deep mines and caverns. All the cases of ice formations occur only in shallow wells, such as the Brandon well, or in caverns of limited extent, such as the one described, where the water is subject to rapid evaporation during the summer months. In deep mines and caverns, the temperature remains constant all the year round. The temperature of the earth increases about one degree for every fifty or sixty feet of descent. In winter, the air of the mine or cavern is warmer than the air on the surface; thus there is a continual rush of the interior heated air toward the surface, and a corresponding inflowing of the cooler air from above. During the summer this process is often reversed, the air in some caverns, which are not very deep, being at a lower temperature, rushes outward, and is replaced by an influx of the more heated atmosphere from the surface. This circulation maintains an equable degree of heat, prevents evaporation, and keeps ice from forming to any appreciable extent either in winter or summer.

But this circulation does not take place in shallow caverns or wells to any great extent, and the water is evaporated rapidly by the heat of the sun in summer, causing the congelation described by Mr. Bicknell. Mr. Hyatt also said that the freezing of water upon the earthen jars during the hottest weather in the East, as mentioned by Rev. Mr. Atwood, could be accounted for in the same way. The evaporating water taking away so much heat from the water, as it exuded through the jar, that a portion of it would freeze.

Mr. Bicknell exhibited a 4-10th inch object-glass, made by R. B. Tolles, of Canastota, New York. This objective had attached to it an "Opaque Illuminator," consisting of a prism of glass inserted in the mounting of the objective, between the front lens and the rest of the combination. Light being thrown into the prism is reflected down through the front lens (which thus becomes the condenser), and is thrown upon the object to be viewed, giving it a very beautiful and brilliant illumination, with ample light for all purposes, and bearing

the higher eye-pieces remarkably well. He stated that he had compared this illuminator with one made by Mr. Wales, of New Jersey, on a plan described by Mr. H. L. Smith, in the "American Journal of Science and Arts," for September, 1855, p. 238, and found the performance of Mr Tolles's illuminator in every respect equal to the one described there.

Mr. C. Cooke gave an account of a visit to Andover in search of Indian remains, and presented portions of two skulls and parts of a skeleton that had been discovered. A skeleton of a child was found enveloped in hemlock bark. He presented a Field Mouse with its nest, and also specimens of *Cicindela*, Tiger Beetles, one species of which he found at the depth of twenty-two inches, and another species three feet below the surface.

Donations to the Library and Cabinets were announced.

Among the donations announced was an old "Spinnet," from the estate of the late Jesse Smith, of this city. This is a stringed musical instrument, played like the piano, by striking the keys, and was formerly much in use. This instrument bears the inscription: "Samuel Blyth, Salem, Massachusetts, fecit," and was undoubtedly made some sixty or seventy years since. Mr. Blyth is remembered by the elder portion of our community as a person of great genius and wit. Robert Cowan, also, made musical instruments of a similar character. William Hook likewise manufactured organs, and his sons, since their removal to Boston, have obtained a world-renowned reputation as manufacturers of organs.

A series of instruments built by these several makers, in the infancy of their manufacture in this country, would form a highly interesting collection for illustrating the history of music in this city.

Nathan Hooper, Edwin Bicknell, Jonathan Kimball, and William Northey, of Salem, were elected Resident Members. W. W. Butterfield, of Indianapolis, Ind., was elected a Corresponding Member.

After the adjournment much interest was manifested in the examination of the lens exhibited by Mr. Bicknell, and the various objects placed under his fine microscope.

WEDNESDAY, NOVEMBER 14, 1866. Quarterly Meeting.

Vice President GOODALL in the chair.

The proposed amendment to the constitution was read for the third time and laid on the table for farther consideration.

The following resolutions were submitted by the Secretary, and unanimously accepted.

The Essex Institute having learned, with much interest, the munificent endowment for the formation and support of a Museum and Professorship of Archaeology and Ethnology at Harvard University, by George Peabody, Esq., a native of this county, — Therefore be it

Resolved: — That the Institute gratefully recognize this direction of Mr. Peabody's liberality, and tender their sincere thanks to him for his confidence placed in this Institution by the appointment of Francis Peabody, Esq., one of the Trustees of this fund, and in designating as his successors the future presidents of the Institute.

Resolved: — That the Secretary be requested to communicate a copy of these resolves to Mr. Peabody.

John W. Perkins, J. P. Dabney, and Miss Ellen M. Dodge, of Salem, and Andrew E. Story, of Beverly, were elected Resident Members.

MONDAY, NOVEMBER 19, 1866. Regular meeting.

Vice President GOODELL in the chair.

Letters received from the following: — The Royal Society, London (Aug. 27); Smithsonian Institution, Washington (Oct. 8); Henry Clark, Montpelier, Vt. (Nov. 6); G. M. Whipple, Salem (Nov. 8); Philip & Solomons, Washington (Nov. 8); Buffalo Historical Society (Nov. 9); Charles P. Preston, Danvers (Nov. 12); J. Kimball, Salem; J. A. Allen, Springfield; S. Jillson, Feltonville (Nov. 13); Rev. E. C. Bolles, Portland, Me. (Nov. 14); John H. Tayte, Salem; R. D. Wilkie, Boston (Nov. 15); W. J. Beal, Union Springs, N. Y.; R. E. C. Stearns, San Francisco, Cal.; T. McIlwraith, Hamilton, C. W.; John P. Abbott, Somerville; Grant, Warren & Co., Boston (Nov. 16); James Gilmer, Boston; W. H. Smith, Claremont, N. H.; R. M. L. Poor, Waltham (Nov. 17); Edwin Bicknell, Salem (Nov. 19).

Mr. Edwin Bicknell made some remarks upon the subject of meteors, mentioning some of the principal ones that had been recorded in history, and alluding to their relative size, composition, probable origin, and the rate of speed with which they traverse the atmosphere. A conversation then ensued upon this general subject, which was participated in by Messrs. F. Peabody, E. S. Morse, A. Hyatt, Geo. D. Phippen, Dr. Nathan R. Morse, and others. Dr. Morse, in the course of his remarks, gave a brief account of the collection of meteorites in the cabinet of Amherst college, the largest in the country, and said to be one of the finest in the world.

Mr. Edward S. Morse spoke of the importance of minutely examining the sandstone meteorites for traces of organic bodies. He did not know but that this had already been done; analysis had already detected the presence of organic matter. One could readily appreciate the profound importance which would be attached to the finding of the minutest fragment of fossil shell or bone in these peculiar meteorites. A generalization of the widest scope would be opened by such

a discovery; and since spectral analysis has shown the unity of elements in celestial bodies, the finding of animal remains would complete the wonderful discoveries, proving the absolute unity in space.

He had never seen sandstone meteorites, but supposed their composition must be due to the disintegration of rocks by water, and their redeposition in beds by sedimentary deposit.

Mr. Benjamin A. Stevens, of De Sota, Wisconsin, exhibited an Indian scalping-knife ploughed up on his farm situated about two miles from the Mississippi River. He said that many Indian Mounds were to be found near his residence, and gave a very interesting account of them. He frequently found many of the rude implements of the Indians, and also their skeletons. This subject, also, gave rise to an interesting conversational discussion relating to the probable origin of the mounds. Allusion was made to the opening of several mounds in Ohio, by Prof. Marsh, of Yale College, who found in some of the mounds charred human bones in such a position and condition as to pretty conclusively show, that some of the mounds must have been intended for sacrificial purposes.

This subject will receive a fresh impetus in consequence of the recent endowment, by George Peabody, Esq., of a trust fund for the foundation and support of a Museum and Professorship of Archaeology, in connection with Harvard University. It is well that this subject should receive early attention, before, by the rapid and progressive strides of civilization, all vestige of these mounds shall disappear and their contents be lost forever.

Among the donations announced, was a large collection of cones of the various pine and spruce trees of California, several specimens of the silver and copper ores of Colorado, and many shells, both fossil and recent, from the Pacific coast, presented by R. E. C. Stearns, President of the California Academy of Science, San Francisco. These specimens called forth remarks from various members, and the thanks of the Institute were voted to Mr. Stearns for his valuable donation. After the transaction of business, the meeting adjourned.

MONDAY, DECEMBER 3, 1866. Social meeting at Hamilton Hall.

GEORGE D. PHIPPEN, Esq., in the Chair.

The second social meeting of the Institute was held this evening, and was attended by nearly three hundred persons, including about twenty gentlemen and ladies from other cities interested in microscopical science.

The object of the meeting, like that of the former one held on

May 1st, was to bring the members and their friends together for social enjoyment and instruction, and especially to increase and develop the interest in microscopical science.

The following was the Programme for the meeting : —

MUSIC.

Introductory, by the Presiding Officer.

Short Addresses by the following Gentlemen : —

Professor JEFFRIES WYMAN, of *Harvard University*,
on the Teeth of Vertebrates.

SAMUEL H. SCUDDER, *Sec'y of the Boston Soc. of Nat. Hist.*,
on the Mouth parts of Articulates.

EDWARD S. MORSE, *Curator of Mollusca at the Institute*,
on the Mouth parts of Mollusks.

ALPHEUS HYATT, *Curator of Palæontology at the Institute*,
on the Mouths of Radiates and Protozoa.

Concluding Remarks by the Rev. E. C. BOLLES, *Sec'y of the
Portland Soc. of Nat. Hist.*

MUSIC.

Examination of the Objects under the Microscopes.

Adjournment of the Meeting. Collation.

MUSIC.

Mr. Phippen stated that the special object of instruction this evening would be the Mouth parts of Animals, and that the various preparations under the microscopes had been selected and made for this purpose. He then introduced the several gentlemen who had kindly consented to address the meeting.

Professor WYMAN, in a very instructive manner, explained the formation and structure of the teeth of vertebrated animals, illustrating his remarks by drawings on the black-board and by specimens.

He first described an ideal tooth, pointing out the different parts, and then proceeded to show how the various forms of teeth met with in animals, as those of a lion, horse, elephant, etc., were modifications of one and the same ideal tooth.

He alluded to some of the uses of teeth, besides those subservient to mastication of food, such as the teeth of the Sword-fish for defence and offence, of the Walrus for locomotion, of the Rattlesnake for the inoculation of virus, etc.

Whalebone was also described as having certain morphological resemblances to teeth.

Mr. S. H. Scudder offered some remarks upon the mouth-parts of articulated animals, with especial reference to those of Insects. He showed that these parts were composed of several pairs of jaws which worked laterally, and not, as in the vertebrates, vertically. In some insects they took the simple form of biting jaws; in others, that of a sucking tube, composed sometimes of one, and sometimes of another pair of jaws; in some cases, this tube enclosed within itself the other pairs of jaws, modified into piercing needles or double-bladed lancets, and moving upwards and downwards through the tube. All these varied forms were shown to be constructed upon a single type. Preparations of different insects, illustrating these points, were exhibited under the microscopes.

Mr. Edward S. Morse called attention to the preparations of snails' tongues under the microscopes, and then explained the various modes in which the Mollusca procure their food.

There were three prominent groups in the Mollusca; the Acephala, the lowest, had the simplest form of mouth, a mere slit, without any hard parts for biting or triturating the food. Their food was of a microscopic character, and by means of ciliary action was swept to the mouth, having previously been drawn within the mantle by the currents of water which bathed the gills.

In the Gasteropods the mouth is generally furnished with a biting-plate on the upper lip, and a tongue armed with a multitude of silicious particles; and with this tongue the food, consisting in some of vegetable matter, in others of animal substances, is rasped, and thus reduced to a state fit for the stomach.

In the highest of the Cephalopods, the mouth is armed with a formidable set of jaws, in form and arrangement like a parrot's beak. With this armature, animals of large size often become an easy prey. They have a tongue similar to the Gasteropods, and, in addition to this, they have powerful arms surrounding the mouth, with which they seize and hold their prey while in the act of feeding.

Mr. Alpheus Hyatt next explained the structure of the mouth and stomach in the Radiates and lower animals known as *Protozoa*. In the highest radiates, he showed that teeth existed, as in the sea urchin (*Echinus*); and how in the polyps and jelly-fishes the mouth was a soft-lipped orifice, destitute of hard appendages.

He described the relations of the stomach to the mouth-parts, and the gradual simplification of the whole digestive apparatus in the lower Radiata and Protozoa, until they ceased to be present at all in the *Amœba*, which opened the external wall of the body at any convenient point, and took in its food.

Thus, by the remarks of the several speakers, we were gradually led
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to see the beautiful arrangement which exists in nature in the adaptation of the various organs to the special habits and mode of life of the different classes of animals.

At the close of the scientific addresses, the Rev. E. C. Bolles, Secretary of the Portland Society of Natural History, alluded in a most eloquent manner to the great good which such meetings as this were doing for the cause of education, and how such institutions as the Essex Institute were advancing, not only the scientific and intellectual, but also the moral tone of the community. In conclusion, the speaker called upon the people to see that an institution like this, which, by its publications, its collections, its library, its meetings, its manufactory of microscopic sections, illustrating the minute anatomy of animals, and its workers in the various departments, was doing so much to advance the great cause of popular education, should not fall in its efforts from the want of warm and active support.

At the close of Mr. Bolles' remarks the settees were removed, and an hour was passed in examination of the objects under the microscopes. These objects were mostly prepared by Mr. E. Bicknell expressly for the meeting, and were very fine, the sections of teeth, especially, being beautifully prepared. There were thirty-four first-class instruments on the tables, each arranged to illustrate some object explanatory of the remarks of the various speakers.

A larger number of microscopes of first-class makers has probably never been brought together in this country before. About half past ten o'clock the meeting adjourned, and those present spent a few hours in a social manner in the supper-room and hall, where, with the assistance of music, all seemed to enjoy themselves. The microscopes had, in the mean while, been removed to the hall below, and the more scientifically inclined remained for several hours comparing instruments and objects. Mr. Stodder here exhibited a four-tenths objective, made by Tolles, and fitted with Mr. Tolles' new arrangement for the illumination of opaque objects, which is accomplished by a prism fitted into the mounting of the objective between the front pair of lenses and rest of the combination; light being thrown into this prism is reflected downwards through the front pair of lenses, illuminating the object in a beautiful manner.

There were thirty-four microscopes exhibited at the Hall, comprising twenty-two different patterns, of fourteen different makers. The most noticeable feature of this exhibition was the improvement which has been effected in a few years in stands, eye-pieces, and objectives, the method of adapting the different parts, and the illumination of opaque objects for examination with high powers.

The following is a list of the microscopes, with the objects shown and powers used.

No. 1. Second class, Zentmeyer stand, with two inch Tolles' objective, owned by R. C. Greenleaf, of Boston. Object, transverse section of Molar Tooth of Ox, showing dentine, cement, and enamel.

No. 2. Nachet microscope, single pillar, one-half inch objective, owned by Salem High School. Object, longitudinal section of Human Incisor Tooth, showing dentine and cement.

No. 3. Nachet, same as above, one-quarter inch objective, owned by H. A. Chapman of Boston. Object, longitudinal section of Human Incisor Tooth, showing dentine and enamel.

No. 4. Nachet, moyen modèle, one-quarter inch objective, owned by Dr. G. A. Perkins, of Salem. Object, section of enamel showing prisms.

No. 5. First class, Smith and Beck binocular, with $1\frac{1}{2}$ inch Wales' objective, owned by Benjamin Webb, jr., of Salem. Object, longitudinal section of lower Canine Tooth of Cat, showing alveolus and pulp cavity.

No. 6. First class, Zentmeyer stand, with $1\frac{1}{2}$ inch Wales' objective, owned by E. Bicknell, of Salem. Object, longitudinal section of Molar Teeth of Cat, in situ, showing blood vessels, etc. (Nos. 5 and 6 were fitted with draw tubes and erecting glasses, thus enabling them to take in the full size of the object, which was seven-eighths of an inch).

No. 7. Second class microscope, by Ladd, of London, two inch objective, owned by Benjamin Webb, jr., of Salem. Object, longitudinal section of Tooth of Dolphin.

No. 8. Microscope made by Clarke, of London, two inch objective, owned by Essex Institute. Object, transverse section of whalebone.

No. 9. Microscope made by Pritchard, of London, one inch objective, owned by Essex Institute. Object, transverse section of a Poison Fang of a Rattlesnake.

No. 10. Oberhaeuser, modèle, No. 2, $\frac{3}{4}$ inch objective, owned by H. F. King, of Salem. Object, transverse section of Tooth of Python.

No. 11. Grünow microscope, two inch objective, owned by H. F. King, of Salem. Object, longitudinal section of Tooth of Cod.

No. 12. Nachet, first class, two inch objective, owned by John Cummings, jr., of Woburn. Object, perpendicular section of Crushing Tooth of Wolf Fish (*Anarrhichas*).

No. 13. Oberhaeuser microscope, modèle, No. 2, two inch objective, owned by John Cummings, jr., of Woburn. Object, transverse section of Tooth of Gar Pike (*Lepidosteus*).

No. 14. Grünow microscope, one inch objective, owned by E. S. Morse, of Salem. Object, transverse section of Tooth of Saw Fish (*Pristis*).

No. 15. Nachet and Son's microscope, one-half inch objective, owned by H. F. Shepard, of Salem. Object, perpendicular section of Dermal Teeth of Saw Fish (*Pristis*).

No. 16. French microscope, one inch objective, owned by H. F. Shepard, of Salem. Object, longitudinal section of Tooth of Skate (*Raja*).

No. 17. Oberhaeuser microscope, one-half inch objective, owned by Dr. Benjamin Cox, of Salem. Object, Mouth-parts of Humble Bee (*Bombus*).

No. 18. Grünow microscope, two inch objective, owned by A. Hyatt, of Salem. Object, Mouth-parts of Butterfly (*Papilio*).

No. 19. Wooden stand, maker unknown, one-half inch Tolles' objective. Object, Mouth-parts of House Fly (*Musca*).

No. 20. Small French microscope, owned by Charles Stodder, of Boston. Object, Mouth-parts of Horse Fly (*Tabanus*).

No. 21. Fraunhofer microscope, simple model, one inch objective, owned by Dr. Henry Wheatland, of Salem. Object, Mouth-parts of Male Mosquito (*Culex*).

No. 22. Oberhaeuser microscope, modèle No. 2, one-half inch objective, owned by John Cummings, jr., of Woburn. Object, Mouth-parts of Female Mosquito (*Culex*).

No. 23. Nachet, first class, one-half inch objective, owned by Rev. J. A. Swan, of Kennebunk, Me. Object, Mouth-parts of Tiger Beetle (*Cicindela*).

No. 24. Nachet microscope, one inch objective, owned by Dr. A. H. Johnson, of Salem. Object, Mouth-parts (Labium) of a Cockroach (*Blatta*).

No. 25. Oberhaeuser microscope, modèle, No. 2, one-half inch objective, owned by Dr. W. L. Bowdoin, of Salem. Object, Mouth-parts (Maxillæ) of a Cockroach (*Blatta*).

No. 26. French dissecting microscope, owned by Essex Institute. Object, entire specimen of Water Bug (*Ectobia*).

No. 27. Oberhaeuser microscope, petit modèle, one-half inch objective, owned by Dr. William Mack, of Salem. Object, Rows of Teeth lining the stomach of the Cricket (*Acheta*).

No. 28. Microscope made by R. B. Tolles, one-half inch objective, owned by S. H. Scudder, of Boston. Object, Mouth-parts of White Ant (*Termes*).

No. 29. Mouth-parts of Shrimp (*Pandalus*), separated and mounted on a large glass slide, to show their relation to corresponding parts in the insect.

No. 30. Microscope made by Charles A. Spencer, one inch objective, owned by Dr. Wells, of Elliot, Me. Object, Mouth-parts of Leech (*Hirudo*).

No. 31. Microscope made by E. G. Wood, London. Two-thirds inch objective, owned by Charles Stodder, of Boston. Object, Jaw of Land Snail (*Succinea*).

No. 28. Microscope made by Murray and Heath, London, one inch objective, owned by Charles Stodder, of Boston. Object, Jaw of Land Snail (*Helix*).

No. 33. Microscope made by Murray and Heath, London, one inch objective, owned by Charles Stodder, of Boston. Object, Tongue of Whelk (*Buccinum*).

No. 34. Zentmeyer, second class stand, with four-tenths inch Tolles' objective, owned by Charles Stodder, of Boston. Object, Tongue of Land Snail (*Helix*).

No. 35. Nacet microscope, of English form, one inch objective, owned by Mass. State Board of Agriculture. Object, Tongue of Beach Cockle (*Natica*).

The sections of teeth exhibited were prepared by Mr. Bicknell, of the Institute Microscopical Department expressly for the occasion. The preparations of the Mouth-parts of Insects, which were very beautiful, were prepared by Mr. John T. Ogden, of Boston, by whom they were kindly loaned.

MONDAY, DECEMBER 17, 1866. Regular Meeting.

Vice President GOODELL in the chair

Letters were announced from George Baker, Providence, R. I. (Nov. 8); Ottawa Academy of Natural Science, Ottawa (Nov. 19); Geo. W. Pease & Co., Salem (Nov. 21); Prof. A. E. Verrill, Yale College (Nov. 22); Prof. Theodore Gill, Washington; Department of the Interior, Washington; L. W. Schmidt, New York; Rev. E. C. Bolles, Portland, Me. (Nov. 24); William Mulr, Fox Creek, Mo. (Nov. 25); L. D. Shepard, Salem (Nov. 27); Dr. Henry Bryant, Boston; William Couper, Quebec, Canada; G. F. Matthew, St. John, N. B.; G. K. Gilbert, Rochester, N. Y. (Nov. 28); W. W. Denslow, New York; S. L. Boardman, Augusta, Me.; Capt. N. E. Atwood, Provincetown (Nov. 29); Dr. William Stimpson, Washington (Nov. 30); H. A. Cutting, Lunenburg, Vt. (Nov. 31); George Scarborough, Sumner, Kansas (Dec. 2); Prof. D. S. Sheldon, Davenport, Iowa; Prof. O. W. Holmes, Boston (Dec. 3); G. W. Peck, New York; Rev. E. C. Bolles, Portland, Me. (Dec. 4); C. P. Preston, Danvers; I. P. Langworthy, Boston (Dec. 5); A. L. Babcock, Sherborn (Dec. 6); Prof. H. C. Wood, jr., Philadelphia, Pa.; C. P. Preston, Danvers (Dec. 7); E. M. Dodge, Salem; Rev. E. C. Bolles, Portland, Me. (Dec. 10); S. Jillson, Feltonville, Mass. (Dec. 12); E. T. Cresson, Secretary Entomological Society, Philadelphia; Dr. E. W. Hubbard, Tottenville, N. Y. (Dec. 14); G. W. Peck, New York; Deyrolle Fils, Paris (Dec 15).

The Secretary read a memoir of the late Hon. D. P. KING, of Dan-

vers, by his son Benjamin Franklin King. Referred to the Publication Committee.

Mr. C. Cooke presented, in the name of H. F. Shepard, a singular spine, reported by the natives to have been found, with a number of others of the same kind, on an island in a salt-water lake situated about five hundred miles west of Zanzibar, Africa.

Mr. E. Bicknell exhibited a section of the spine under the microscope, and described its singular structure. Mr. Bicknell said that the spine was unlike any heretofore examined by him, and differed in many respects from those of a fish, though it might prove to be a spine of some unknown genus of that class.

Dr. A. S. Packard, jr., presented, in the name of Miss Mack, a larva of *Thereva*?, or, more probably, a *Scenopinus*, a singular Fly, found under a carpet on which it was probably feeding.

Westwood states that the larva of *Thereva* lives in mould and rotten wood, where it undergoes its transformations. A specimen from Hingham, in the Museum of the Boston Society of Natural History, was said to have had the same habit of feeding on carpets, as the specimen presented to-night.



This larva is long, filiform, cylindrical, smooth, gradually tapering toward the head and tail, being thickest in the middle of the body. There are thirteen segments exclusive of the head. The three thoracic and first abdominal rings are of the same length, but the remaining abdominal segments are contracted, just behind the middle, by a well-marked constriction which can with difficulty be distinguished from the actual sutures between the segments, so that it appears at first sight as if composed of twenty segments exclusive of the head; and it was not until we had compared this larva with that of *Mycetobia palipes*?, found in the summer under the bark of the apple-tree, where the segments are similarly constricted, though in a less marked degree, the hinder division of the ring being much the smaller, that the true number of segments was satisfactorily determined. The twelfth ring tapers much more rapidly behind than the others, while the thirteenth, or terminal segment, is much slenderer, ending in a pair of rather slender legs. There are one or two long hairs arising on each side of each of the thoracic and last abdominal ring.

The head is conical, flattened beneath, one-third longer than broad; it is reddish corneous, while the body is white. Length, .65, breadth, .04 inch. It is very active in its habits, also resembling *Mycetobia* in this respect, jerking its body rapidly when disturbed.

A number of donations to the Library and Museum were announced.

W. W. Lander, of Salem, and Josiah A. Haskell, of Beverly, were duly elected Resident Members.

*Additions to the Museum and Library during October,
November, and December, 1866.*

TO THE NATURAL HISTORY DEPARTMENT.

BY DONATION.

ASHBY, W. A., Salem. Specimen of the Widah Bird, female.

BABCOCK, AMORY L., Sherborn, Mass. Native Birds, from Sherborn.

BEAL, W. J., Union Springs, N. Y. Three Specimens of *Gasterosteus*, from Union Springs.

BERTRAM, Capt. JOHN, Salem. Malformed Egg of the domestic fowl.

BOLLES, Rev. E. C., Portland, Me. Three bottles of Insects in alcohol, from Westbrook, Me. Guano, from a northern locality.

BUTTRICK, S. B., Salem. Piece of Trap Rock, from Buddy Getchell's Swamp, Marblehead.

CALEF, G. F., Saco, Me. Specimens of Grass from marshes in the vicinity of Saco. "Six weeks' Corn," from Fort Randall, Dacotah. Sand, from Prout's Neck, Scarboro', Me.

CARLTON, OLIVER, Salem. Quartz, from Lyndeborough, N. H.

COOKE, C., Salem. Portion of Skull of an adult Indian; also portions of the Skull and the Femurs of a young Indian, dug up at Andover, on the banks of the Merrimac River. Specimen of Field Mouse and its Nest, from Andover. Parasitic Worms from a Flounder taken in Salem Harbor. Specimens of Sponge from beaches in Beverly. Two young White Rats, raised in Salem.

COOKE, Mrs. WILLIAM, Salem. Snow-bird, from Salem.

COVIL, T. N., Salem. Three specimens of *Venus mercinaria*, from Virginia.

DOWBRIDGE, ANDREW, jr., Salem. Specimen of a young Halibut (*Hippoglossus Americanus*), weighing two pounds, taken near Half-way Rock, off Swampscott.

DRINELL, JOSEPH. Living specimen of Fish Hawk, taken at Liberty Hill, North Salem.

EMERTON, JAMES H., Salem. Red-throated Diver, taken at Salem.

FELT, JOHN, Salem. Portion of the right side of the under jaw, and a vertebra of an Indian Skeleton dug up in Lagrange street, South Salem, October, 1866.

GOULD, JOHN M., Yohanny, Georgetown District, S. C. Several specimens of Frogs and Insects, from Yohanny.

GROVER, WILLIAM, Salem. The large Claws of *Lupa dicantha*, taken alive in the Mill-pond, Salem, Mass., Dec. 18, 1866.

JOHNSON, EMERY S., Salem. Specimen of Ruddy Duck (*Erismatura rubida* Bon.), female, shot in South Salem.

JONES, GEORGE W., Salem. Living specimen of Barred Owl (*Syrnium nebulosum*), taken at Beverly.

KIMBALL, J., West's Beach. A large Spider, from woods near West's Beach.

LORD, WILLIAM, North Beverly. Fresh specimen of the Little Auk, found in Beverly.

MACK, DR. WILLIAM, Salem. Living specimens of the Tree Toad (*Hyla versicolor*), from Salem.

MOORE, DAVID, Salem. Portions of the skeleton of an Indian dug up in Lagrange street, South Salem.

NORRIS, CHARLES H., Salem. Several Minerals from Greenland.

PACKARD, DR. A. S., jr., Salem. Four specimens of Bird Lice, found upon the Barred Owl. Three specimens of Quartz scratched by glaciers of the Saco Valley, Me. Specimens of Arsenical Pyrites and Tin Ore, from Tin Mountain, Jackson, N. H.

PICKMAN, H. D., Boston. A collection of Minerals from various localities.

PRAY, ISAAC C., Salem. Alcoholic specimen of *Mygale* sp., from the West Coast of Africa.

PUTNAM, F. W., Salem. A Bat and a collection of Insects, from Wenham.

SEARS, J., Danvers. Larva of an Insect, from a spring in Blind-hole Swamp, Danvers. Specimens of *Aphis*, from Black Alder. *Coluber punctatus*, from Danvers.

SHELDON, Prof. D. S., Burlington, Iowa. Specimens of Fresh-water Fishes, Crustaceans, and Insects, from Burlington, Iowa.

SHEPARD, HENRY F., Salem. Heads of Woodcock, Snipe, Quail, and Hare, from vicinity of Salem. Fossil spine of a Fish?, from the interior of Africa.

STEVENS, E. C., Salem. A fine collection of Shells, Fossils, and Minerals, from the West Coast of North America.

STONE, FRANK, Salem. Redheaded Woodpecker, from Salem.

STORY, A. E., Beverly. Specimens of Mica Slate, showing peculiar contortions, from the beach at Beverly Farms.

TREFREN, JAMES, Austin, Nevada. Specimens of Gold Ore, from the Bay State Company, Empire City, Colorado; from the Gregory Consolidated Ledge, Black Hawk Territory; and from the Mother Ledge, Kingston, Nevada. Specimens of Silver Ore, from the Comstock Ledge, Virginia City, Nevada; and from the Buel, North Star Mine, Austin, Nevada. Specimens of Galena, from the Rocky Mountains, Colorado.

VIENNA, K. K. ZOOLOGISCH MUSEUM (through SMITHSONIAN INSTITUTION). 586 specimens, comprising 316 species of *Lepidoptera*, from Europe.

WARD, Capt. JAMES, Salem. Chameleon, from the South-west Coast of Africa, and the Tail of an Elephant, from the same locality.

WATERS, E. STANLEY, Salem. Leaf from a species of Palm, and specimens of Broom Corn. Specimen of *Sytnium nebulosum*, Barred Owl, shot in Salem.

YALE COLLEGE, CABINET OF. A fine collection of Crustacea, Mollusks, Radiates, and Worms, principally from Long Island Sound, a few from Panama and the East Indies, amounting in all to 436 specimens, 70 species.

TO THE HISTORICAL DEPARTMENT.

BY DONATION.

BOLLES, Rev. E. C., Portland, Me. Two Cups showing a singular effect of fire, from the ruins of the Portland fire, July, 1866.

CRAMPTON, WILLIAM, Salem. A Seal-skin Purse, Strap used by the women for holding up the dress, and a Watch-case made of leather, from Greenland.

HOLMES, JOHN C., Lynn. A pair of ancient Horse Pistols. A Cap worn by the natives of ———.

JOHNSON, EMERY S., Salem. A pair of Chinese Shoes.

PICKMAN, FRANCIS W., Salem. Capital of a Column, and portion of a Tablet with an inscription, from Ephesus.

ROPES, CHARLES A., Salem. Shield made of Hippopotamus hide.

SMITH, JESSIE, Heirs of, Salem. An ancient Spinnet, made by Thomas Blyth.

TAYLOR, BENJAMIN, South Danvers. Ancient Spoon dug up in the cellar of Giles Cory's house.

WARD, Capt. JAMES, Salem. Specimens of Native Manufacture from the South-west Coast of Africa.

WATERS, E. STANLEY, Salem. A Chinese Paper Kite. Piece of the Marble Tablet from the old Franklin Building. Powder Flask, made of paper.

WHEATLAND, GEORGE, jr. Model of a Chinese Coffin.

TO THE LIBRARY.

BY DONATION.

ALLEN, J. F. Transactions of Mass. Hort. Soc., four numbers, 8vo. 22 Pamphlets.

BENSON, LAWRENCE S., Aiken, S. C. Several Pamphlets.

BOLLES, Rev. E. C., Portland, Me. Portland Directories, 1831, 1847-8, 1856, 1858-9, 1863-4, 5 vols. 16mo. Maine Register, 1843, 1 vol. 16mo, Augusta, 1843. Maine Reference Book, 1845, 1 vol. 16mo, Portland. PROCEEDINGS ESSEX INST., VOL. V. 13 SEPT., 1867.

land, 1845. Maine Business Directory of the subscribers to the new map, 8vo, 1 vol., Portland, 1861. 24 Masonic Pamphlets. 52 Miscellaneous Pamphlets. Sundry Newspapers.

BREVOORT, J. C., Brooklyn, N. Y. Third Annual Report of Long Island Historical Society, May, 1866, 8vo, pamphlet.

BROOKS, HENRY M. Plan of Boston Harbor, 1835. Lloyd's New Map of Mississippi River from Cairo to its mouth, 1865.

BROWN, NEHEMIAH. Adjutant-General's Reports (Mass.) for 1864 and 1865, 2 vols. 8vo, Boston, 1865 and 1866.

CALEF, GEORGE F., Saco, Me. Directories of Saco and Biddeford, 12mo, 2 vols., 1849, 1856-7.

CHAMBERLAIN, MRS. JAMES, Almanac for 1785.

CHASE, GEORGE C. Friend's Review, Nine Nos.

CREAMER, GEORGE. 3 Pamphlets.

DENSLOW, W. W., New York. Autograph Letter of C. S. Rafinesque to Dr. John Torrey, dated Philadelphia, Oct. 5, 1828.

DUMÉRIL, AUG., Paris. Duméril's Observations sur la monstruosité dite Polymelie chez des Batraciens, 4to, pamph. Ditto, sur des Lepidosireniens, 4to, pamph. Ditto, Lettre relative au Catal. des Reptiles du Muséum d. Hist. Nat. de Paris, 4to, pamph. Ditto, 3me Notice sur la Ménagerie des Rept. du Muséum de Hist. Nat. 4to, pamph.

GOODWIN, W. F., Librarian New Hampshire Historical Society. Leavitt's Farmers' Almanacs for thirty years, 12mo, pamphlet, 30. Adjutant-General's Report of New Hampshire, vol. 1, 8vo, Concord, 1866. Leavitt's Farmers' Almanac for 1867, Concord, 1866.

GREEN, SAMUEL A., Boston. Boston Municipal Register, 1863, 1864, 2 vols. 8vo. 41 Pamphlets.

HARRIS, J. W., Cambridge. Shepherd, William, Dialogus Poygli Braeciolini Florentini, an Seni sit uxor ducenda, 1 vol. 8vo, Liverpool, 1805.

HOTCHKISS, Miss SUSAN V., New Haven. New Haven Directory, 1854-5, 1 vol. 12mo, New Haven, 1854.

JACOBS, WARREN M., South Danvers. 25 Almanacs from 1712 to 1745.

LANGWORTHY, ISAAC P., Chelsea. James Gilfillan, The Sabbath, 1 vol. 12mo, New York, 1866. The Congregational Quarterly for January, April, and July, 1866.

LEWIS, W., Boston. Fourteenth Annual Report of Trustees of Boston Public Library, 8vo, pamphlet, Boston, 1866.

LORD, N. J. Files of Boston Post, for July, August, September, 1866.

MARSHALL, ORSAMUS, H., Buffalo, N. Y. The Niagara Frontier, embracing Sketches of its Early History, by O. H. Marshall, 8vo, pamphlet, Buffalo, 1865.

MASSACHUSETTS SECRETARY OF STATE. Public Documents of Massachusetts, for 1865, 4 vols. 8vo, Boston. Industry of Massachusetts, 1865, 1 vol. 8vo, Boston, 1866. Acts and Resolves of Massachusetts, 1866, 1 vol. 8vo, Boston, 1866.

MCQUILLEN, Dr. J. H., Philadelphia. Cuvierian Classification of Animated Nature, by J. H. McQuillen, 8vo, pamphlet, 1866.

MORSE, E. S. Bacon's Railway Map of America, Nos. 1, 2, 3, 4. 5 Pamphlets.

NELSON, H. M., Georgetown. Six Reports of Towns of Essex County, 1866.

PERRY, AUGUSTUS. The Abbot, by Sir Walter Scott, 1 vol. 8vo, Boston, 1820. Barber's Grammar of Elocution, New Haven, 1832. Bozman's History of Maryland, 1 vol. 8vo, Baltimore, 1811. Brazer's Essay on the Doctrine of Divine Influence, Boston, 1835. Bremer's Home of the New World, vol. 1, 8vo, New York, 1853. Brooke's Daily Monitor, 1 vol. 8vo, Boston, 1828. Cohen's Notices of Florida and the Campaigns, Charleston, 1836. Connoisseur, by Mr. Town, Oxford, 1774. The Cry: A New Dramatic Fable, vol. 1, London, 1754. Dwyer's Essay on Elocution, Albany, 1846. The Fortunes of Nigel, 1 vol. 8vo, Boston, 1822. Gray's Genera Floræ Americæ Boreali-Orientalis Illustrata, vol. 2, 8vo, New York, 1849. Greenwood's Lives of the Apostles, Boston, 1835. Hawkesworth's Adventures of Telemachus, London, 1819. Keatinge's History of the Conquest of Mexico, 2 vols. 8vo, London, 1803. Littell's Living Age, 333 numbers, from July, 1846, to April, 1854. Lord's Universal Biography, 2 vols. 8vo, New York, 1825. Lucian's Dialogues, Philadelphia, 1806. Mansfield's Legal Rights of Women, Salem, 1845. Marvel's Reveries of a Bachelor, New York, 1853. Miles's Lowell as it was, and Lowell as it is, Lowell, 1845. Millott's Elements of General History, vols. 2, 3, 4, 5, 8vo, Salem, 1796. An Offering of Sympathy, Boston, 1830. Pitts-street Chapel Lectures, 1 vol. 8vo, Boston, 1858. Pope's Works, 6 vols., Boston, 1808. The Port Folio, 8 vols. 8vo, Philadelphia, 1809, &c. Collections of Psalms and Hymns, New York, 1827. Probus; or Rome in the third Century, 2 vols., New York, 1838. Proceedings at Mr. George Peabody's Parting Dinner, London, 1851. Roscoe's Life and Pontificate of Leo the Tenth, 4 vols. 8vo, Philadelphia, 1805. Smith's Wealth of Nations, 2 vols. 8vo, Hartford, 1818. Spear's Names and Titles of Jesus, Boston, 1841. Stewart's Philosophy of the Human Mind, vol. 2, 8vo, Boston, 1814. Tales and Romances of Sir Walter Scott, vol. 5, 8vo, Boston, 1821. Tytler's Elements of General History, 1 vol. 8vo, Philadelphia, 1809. Waterman's Religious Offering, Philadelphia, 1840. Whiston's Works of Flavius Josephus, 1 vol. 8vo, Baltimore, 1836.

PICKERING, JOHN, *Histoire Naturelle et Morale der Iles Antilles de l'Amerique*, 1 vol. 8vo. Rotterdam, 1658.

PICKMAN, B., Boston. *Acts passed by the Sixth Legislature of the State of Louisiana*, Baton Rouge, 1861. *Adams's History of the Jews*, 2 vols. 8vo, Boston, 1812. *Adams's View of Religions*, 1 vol. 8vo, Boston, 1801. *Akenside's Pleasures of Imagination*, Portland, 1805. *Allison's Sermons*, Boston, 1815. *Almanach De Gotha*, 1856. *Monthly Journal of the American Unitarian Association*, vol. 3, Boston, 1862. *Appleton's Introduction of the Power Loom, and Origin of Lowell*, Lowell, 1858. *Austin's Life of Elbridge Gerry*, Boston, 1829. *Bachi's Italian Grammar and Exercises*, Boston, 1838. *Bartol's Church and Congregation*, 1 vol. 12mo, Boston, 1858. *Bartol's Word of Spirit to the Church*, 1 vol. 12mo, Boston, 1859. *Bigland's View of the World*, 3 vols. 8vo, Boston, 1811. *Boston's Sermons*, Edinburgh, 1744. *Botta's History of the War of the Independence of the United States*, 2 vols., New Haven, 1838-42. *Bowditch's History of the Massachusetts General Hospital*, Boston, 1851. *Bowen's Picture of Boston, or the Citizen's and Stranger's Guide*, Boston, 1829. *Bradford's Life of Jonathan Mayhew*, Boston, 1838. *Bradshaw's Continental Railway Guide*, London, 1857. *Briffault's Prisoner of Ham*, London, 1846. *Brook's Simplicity of Christ's Teachings*, Boston, 1859. *Dr. Buchan's Family Medical Works*, Charleston, 1807. *Buckminster's Sermons*, Boston, 1814. *Camerini's L'Eco Italiano*, London, 1857. *Chambers's History of the English Language*, fourth edition, Edinburgh, 1837. *Chevalier's Society, Manners, and Politics in the United States*, Boston, 1839. *Cicero's Orations*, Exeter, 1809. *Colman's European Agriculture*, Boston, 1846. *Colman's Sermons*, 1 vol. 8vo, Boston, 1820. *Commedie Scelte Di Carlo Goldoni*, 1856. *Cowper's Private Correspondence*, Philadelphia, 1824. *Dall's Essays and Sketches*, Boston, 1849. *Diary and Correspondence of the late Amos Lawrence*, Boston, 1856. *Dicken's Dombey and Son*, Boston, 1848. *Dillaway's Roman Antiquities*, second edition, Boston, 1833. *Emerson's North American Arithmetic*, Part Third, Boston, 1839. *Europe*, Boston, 1822. *Ferguson's Essay on the History of Civil Society*, Boston, 1809. *Follen's Works*, 5 vols. 12mo, Boston, 1841. *Folsom's Despatches of Hernando Cortes*, New York, 1843. *Galignani's New Paris Guide*, 1855. *Gaultier's Lectures Graduees*, Paris, 1881. *Good Health*. *Goodrich's Lessons in Greek Parsing*, second edition, New Haven, 1832. *Greene's Reflections in Retirement*, Boston, 1834. *Greenwood's Sermons of Consolation*, 1 vol. 12mo, Boston, 1842. *Gurney's Love to God*, eighth edition, Norwich, 1856. *Hall's Memoir of Mary H. Ware*, Boston, 1853. *Harris's Memorials of Oglethorpe*, 1 vol. 8vo, Boston, 1841. *Hudson's History of Marlborough, Mass.*, Boston, 1862. *History of the Humane*

Society, Boston, 1845. Jameson's Sisters of Charity, 1 vol. 12mo, Boston, 1857. Kater's Treatise on Mechanics, Philadelphia, 1838. Kenrick's Exposition of the New Testament, 3 vols., Boston, 1828. Landing at Cape Anne, by Thornton, Boston, 1854. Law's Call to a Devout and Holy Life, Boston, 1808. Letters from an Elder to a Younger Brother, Boston, 1810. Livermore's Four Gospels, with a Commentary, vol. 1. Lowell's Occasional Sermons, Boston, 1855. Lowell's Practical Sermons, Boston, 1855. Lyteria: A Dramatic Poem, Boston, 1854. Martineau's Devotional Exercises, Boston, 1833. William Mather's Elements of Geology, Norwich, 1833. Richard Mather's Journal and Life, 1 vol. 12mo, Boston, 1850. Maury's Englishwoman in America, London, 1848. Meikle's Solitude Sweetened, Exeter, 1831. Mitford's History of Greece, 8 vols. 8vo, Boston, 1823. Monti's Grammar of the Italian Language, 1 vol. 12mo, Boston, 1855. Monti's Italian Reader, Boston, 1855. Mt. Auburn Map. Murray's English Grammar, 1828. Murray's Hand-book, Sardinia, Lombardy, and Venice, two parts, London, 1858. Neal's History of the Puritans, 5 vols. 8vo, Newburyport, 1816, &c. New England Genealogical Antiquarian Register, 16 vols. 8vo, Boston, 1847. New Testament, Baltimore, 1835. Ollendorff's Key to the Exercises in the New Method of Learning to Read, Write, and Speak a Language in six months, 1 vol. 12mo, New York, 1850. Ollendorff's New Method of learning to Read, Write, and Speak the Italian Language, New York, 1849. Palfrey's Lectures on the Evidence of Christianity, 2 vols. 8vo, Boston, 1843. Palfrey's Lectures on Jewish Scriptures, &c., 4 vols. 8vo, Boston, 1838, &c. Palfrey's Relation between Judaism and Christianity, 1 vol. 8vo, Boston, 1854. Phillips's Guide to Crystal Palace and Park, two editions, 1855, 1857. Picture of London, a Correct Guide, 1805, 1816. Plant's Picture of Paris, or the Stranger's Guide, 1814. New Pocket Plan of London, 1803. Post-roads in France, 1815. Collection of Psalms and Hymns for Christian Worship, Boston, 1843. Quits, by the Baroness Tautphœus, 2 vols., Philadelphia, 1857. Roberts's Memoirs of Mrs. Hannah More, vol. 2, New York, 1835. Russell's Tour in Germany, 1 vol. 8vo, Boston, 1825. Sale's French Dialogues, Boston, 1829. Sir Walter Scott's Life of Napoleon, 3 vols. 8vo, Philadelphia, 1827. Shaw's Description of Boston, 1817. Simpkins's Exercises for Private Devotion, Boston, 1837. Smellie's Philosophy of Natural History, Boston, 1838. Smith's Wealth of Nations, 2 vols., Hartford, 1804. Spring's Essays on the Distinguishing Traits of Christian Character, 1 vol. 8vo, New York, 1813. The Stranger in Liverpool, 1815. Sullivan's Political Class Book, Boston, 1831. Testament Le Nouveau, 1816. Thornton's Mementos of the Swett Family, 1851. Tiffany's American's Sojourn in the Celestial Empire, 1 vol. 12mo, Boston, 1849. Sketches of

the Tower of London, London, 1857. Tronchet's Guide to all the Public Buildings in Paris, 1815. Dr. Trueman's Visit to Edinburgh, 1840. Tudor's Life of James Otis, 1 vol. 8vo, Boston, 1823. Tytler's Universal History, 2 vols. 8vo, Boston, 1840. Henry C. Van Schaack's Life of Peter Van Schaack, New York, 1842. Wanostrocht's Grammar of the French Language, Philadelphia, 1838. Wardlaw's Discourses, Andover, 1815. Warren on Preservation of Health, Boston, 1846. West Church and its Ministers, Boston, 1856. Wilkins's Elements of Astronomy, Boston, 1834. Wirt's Sketches of the Life and Character of Patrick Henry, 1 vol. 8vo, Philadelphia, 1818. Wisner's Memoirs of Mrs. Susan Huntington, Boston, 1826. Worcester's Elements of Geography, Boston, 1838. Worcester's Gazetteer, 2 vols. 8vo, 1817.

PRESTON, CHARLES P., Danvers. Handbills of Essex Agricultural Society for several years. 5 Pamphlets.

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MISSOURI STATE HORTICULTURAL SOCIETY. First Annual Report of Missouri State Board of Agriculture, 1 vol. 8vo, Jefferson City, 1866.

NEW ENGLAND HISTORIC-GENEALOGICAL SOCIETY. New England Historic-Genealogical Register for October, 1866.

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PROVIDENCE ATHENÆUM. Report at Thirty-first Annual Meeting, September, 1866, 8vo, pamphlet.

ROYAL SOCIETY, LONDON. Proceedings, Vol. XV. Nos. 83, 84, 85, 86.

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vember, December, 1866. Lawrence American, October, November, December, 1866. Lynn Reporter, October, November, December, 1866. The Reader (London), October, November, December, 1866. South Danvers Wizard, October, November, December, 1866. Trübner's American and Oriental Literary Record, October 1, November 2, 1866.

MONDAY, JANUARY 7, 1867. Regular Meeting.

Vice President GOODELL in the chair.

Letters were announced from, —

Buffalo Historical Society (Dec. 15); Dr. Wm. Prescott, Concord, N. H. (Dec. 17); Prof. A. E. Verrill, Yale College (Dec. 19); Massachusetts Institute of Technology; Prof. H. C. Wood, Philadelphia, (Dec. 20); G. L. F. Ball, Boylston (Dec. 24); H. A. Cutting, Newberry, Vt. (Dec. 26); T. A. Cheney, Watkins, N. Y. (Dec. 27); E. Stelzer, New York; Dr. E. Suffert, Havana, Cuba (Dec. 29); Miss Blaikie, Boston Soc. Nat. History (Dec. 30); Rev. E. C. Bolles, Portland Soc. Nat. History (Dec. 31); Henry Cook, Boston (Jan. 2); Dr. Elliott Cones, U. S. A., Columbia, S. C. (Jan. 5).

The Superintendent presented a paper by Dr. Elliot Coues, entitled *Catalogue of the Birds of North America contained in the Museum of the Essex Institute, with which is incorporated a List of the Birds of New England, with brief critical and field notes.* Referred to the Publication Committee.

The Secretary presented a communication from the Historical Society of Pennsylvania, on the subject of Memorializing Congress that every reasonable facility be furnished to the several Historical Societies and Public Libraries in the United States, to enable them to increase the number of their books, pamphlets, and Historical papers, by modifying the existing laws so as to permit postage on books, pamphlets, documents, and papers forwarded to such Institutions to be paid on delivery, and that the rates of postage on the above-mentioned articles be reduced fifty per cent. below the present rates. Referred to the President and Secretary to take such action as they may deem advisable.

Mr. William P. Upham read the following extract from the town records, it being the appointment of Tythingmen for the year 1678:—

"Jeremiah Meacham Sen., from ye bridge to Goody Kitchins all ye North side of ye way. John Reaves, from Wm. Beanes to Jno. Mason all ye South side of ye way. Eleazer Gedney, all Mr. Ruck's Village.

"Mr. John Hathorne, from Abram Cole's corner to Mr. Batter's corner all ye North side of ye way. Mr. John Ruck, from Jno. Mason's corner to Tho. Cromwell's all the South side of ye way. John

Ropes, from Capt. Price's corner to Mr. Brown's corner all ye North side of ye way. Mr. Willoby, from Edward Mould's corner to James Poland's at ye South side of ye way. Samuel Williams, from Samuel Prince's to Samuel Gardner Sens. corner all ye North side of ye way. Elias Mason, from Goodman Romball's corner and Jno. Higginson's corner to John Jngerson and Richard Princes corner all both North and South side of ye way. Henry Skerry Jr., from Mr. Higginson Sen. to Ipswich Ferry. Jonathan Eager, from his house to John Beckett's ye sea side and fields. Isaac Foot, from Jona. Eager's to Andrew Woodbury's and from John Robinson's to Richard Robert's. Mr. Phippeny from John Becketts and Andrew Woodbury's to John Cliffords."

"The way" was what is now Essex street. On the north side the divisional lines were Beckford, Washington, St. Peter, Newbury, and Pleasant streets; on the south side Summer, Central, Elm, and Daniels streets. The localities referred to were further explained. The duties of the Tythingmen were defined in an act of the General Court May 24, 1677, "to inspect the ten families of his neighbours," and to have power "to apprehend all Sabbath breakers and disorderly tipplers" or such as "suffer any disorders in their houses on ye Sabbath day, or evening after."

Mr. Caleb Cooke made some remarks on the Sea-coco, *Lodoicea Sechellarum*, a specimen having been presented by Capt. S. A. Lord.

Mr. E. Bicknell exhibited under the microscope, specimens of *Cisticercus*, taken from measly pork, presented by the Bdston Society of Natural History, and made some remarks on the history of the Parasite.

Mr. Bicknell also exhibited sections of the poison fangs of the Rattlesnake, and gave an account of the structure of the fangs.

Donations to the Library and Museum were announced.

Charles Ray Palmer, Alexander Donaldson, Daniel H. Johnson, Thomas Saul, and Amos H. Johnson, all of Salem, were elected Resident Members.

MONDAY, JANUARY 21, 1867. Regular Meeting.

Capt. H. F. KING in the chair.

Letters were announced from, — Rev. E. C. Bolles, Portland, Me. (Jan. 8); B. F. King, Boston (Jan. 9); Henry Davis, McGregor, Iowa (Jan. 11); Dr. J. Bernard Gilpin, Halifax, N. S. (Jan. 12); Rev. E. C. Bolles, Portland, Me.; Horace Mann, Cambridge (Jan. 13); Bureau of Statistics, Treasury Department, Washington; Dr. D. H. Storer, Boston (Jan. 15); Anson Allen, Orono, Me.; S. R. Carter, Paris, Me.; J. E. Chase, Boston; A. L. Babcock, Sherborn (Jan. 16); Maine Historical Society; H. B. Rice, Boston; Charles Stodder, Boston; Rev. Samuel Lockwood, Keyport, N. J. (Jan. 18); John Krider, Philadelphia; M. S. Bebb, Washington (Jan. 19); H. B. Lord, Ithaca, N. Y.;

Rev. Joseph Banvard, Paterson, N. J. (Jan. 20); William Cowper, Quebec, Canada; C. L. Jackson, Secretary Harvard Natural History Society; Dr. William Wood, East Windsor Hill, Conn.; Capt. Samuel A. Lord, Salem; Rev. E. C. Bolles, Portland, Me. (Jan. 21).

Mr. F. W. Putnam called attention to a recent publication by Dr. J. Bernard Gilpin, of Halifax, on the Salmon, and gave a resumé of the observations of Dr. Gilpin. He also spoke on the habits of the Salmon and several other fishes during the breeding season.

Mr. Putnam also exhibited two snakes from Hong Kong, recently presented by James Coolidge, and remarked on the character of the Reptile fauna of China as compared to that of North America.

A number of members then discussed the origin of the *Black Wart* on the Plum Tree. The disease was regarded as being due to a constitutional decline of the tree, during which the bark loosens and cracks open, when a fungus (*Sphaeria morbosus*) locates itself on the diseased parts, giving it a swollen and black appearance. The grubs of the Plum Weevil often live in the wart, but they have no agency in producing it.

Donations to the Museum and Library were announced.

John Cummings, jr., of Woburn, was elected a Corresponding Member. Albert G. Browne, of Salem; A. B. Hervey, of South Danvers; and Frederick A. Ober, of Beverly, were elected Resident Members.

MONDAY, FEBRUARY 4, 1867. Regular Meeting.

Vice President GOODELL in the chair.

Letters were announced from, — I. F. Holton, Boston (January, 17); Miss J. H. Spear, Burlington, Vt. (January 21); W. H. Niles, Cambridge; Dr. William Prescott, Concord, N. H.; Massachusetts Institute of Technology; Hiram A. Cutting, Lunenburg, Vt.; John A. Russell, New York; Josiah Stickney, Boston; Prof. Jonathan Pearson, Union College (January 22); Robert Brown, jr., Cincinnati, Ohio; New York Lyceum of Natural History; Dr. F. A. Tellkamp, New York (January 23); W. E. Doggett, Chicago, Ill.; Prof. H. C. Wood, jr., Philadelphia, Pa.; U. P. James, Cincinnati, Ohio; C. M. Wheatley, Phoenixville, Pa. (January 24); J. H. Salisbury, Cleveland, Ohio; W. H. Dall, Fort St. Michaels, Russian America; George Baker, Providence R. I. (Jan. 26); Buffalo Historical Society (Jan. 28); R. M. Devens, Pocasset; A. M. Edwards, New York; G. A. Boardman, Milltown, Me. (Jan. 29); J. E. Chase, Boston (Jan. 30); J. E. Chase, Boston; E. G. Squier, Boston (Jan. 31); Mrs. L. A. Swazey, Salem; Miss Julia H. Spear, Burlington, Vt.; W. H. Dall, Fort St. Michaels, R. A. (Feb. 1); Henry Cook, Boston; V. T. Chambers, Covington, Ky.; T. A. Cheney, Watkins, N. Y. (Feb. 2); C. J. Maynard, Newtonville (Feb. 4).

Mr. R. S. Rantoul read a letter from Col. Henry Whipple, of Salem,

transmitting for safe-keeping the seal of the "Eastern Stage Company," and offering some extracts from the records of the Company. It was chartered in 1818 for twenty years. It ran coaches between Boston, Portland, Essex, Gloucester, etc. When it expired, in 1838, the Boston and Lowell Railroad had pushed out a spur towards Andover and Haverhill, and the Eastern Railroad was opened to Salem in August of that year. The directors, with four or five hundred horses on hand, and unable, up to the last moment, to reduce their stock because travel was increasing, were in a trying dilemma, but acquitted themselves to general satisfaction. The safe, speedy, and cheap transportation of persons and property was one of the great problems of modern civilization. Commerce had heretofore enjoyed the sea freely. Now a new inland commerce was springing up, which was necessarily under restraints and controlled by few persons. They can create towns and raise or depress real estate, and affect the price of commodities. This raises an interesting problem, — one which is just now attracting great and deserved attention.

Hon. Allen W. Dodge hoped that a history of the Stage Company might be gleaned from its records. He remembered in his boyhood, at Exeter, the entire confidence of the community in its financial and practical management. Even the drivers were important characters. He spoke highly of some of the corporators, and repeated verses written by Miss Hannah F. Gould, on the passage of the mail-coach through Newburyport, when the writer was anxiously awaiting news from a sick relative.

Mr. Rantoul, after some general remarks, then narrated several facts relating to the history of Chipman Hill, in Beverly, which he had gleaned during his antiquarian researches. It was named for an eminent and scholarly family. It was sold by General H. K. Oliver's father, to "that notorious Hugh Hill," the terror of the commerce of the British channel during the Revolution. He captured and brought home the library which, as Dr. Bowditch says in his will, formed the nucleus of the Athenæum, and excited the Dr.'s interest in the mathematical sciences. The late Lieutenant John Hill, of Salem, in trying to trace a relationship between himself and Hugh Hill, thought he had discovered that Hugh Hill was a cousin of Andrew Jackson. Facts were stated bearing on this theory. — [Printed in full in the HISTORICAL COLLECTIONS, Vol. VIII.]

Mr. Dodge presented two antique metallic spoons, one of which was found in Hamilton, and the other, which he presented in the name of Captain Samuel Day, was found at Ipswich Beach. On comparison with other old spoons in the collections of the Institute, it was found that there were several of the same kind as those presented, and that

one or two of them had been found in Indian graves in this vicinity. They were probably the kind of spoons used by the first settlers, and from them found their way among the Indians.

Mr. Dodge read a letter written by Samuel Whipple to William Jepson at Boston, June 2, 1725, which contained a number of allusions to the customs and costumes of that period.

Mr. F. W. Putnam exhibited a singular specimen of the Horned Pout, *Pimelodus*, from Lake Champlain, presented by Dr. Benjamin Pickman, of Boston. The fish was fully grown and was of a pure white color. This was the first instance that had come under his observation of pure albinism in the class of fishes, and he had never seen any account of its having been noticed before.

Donations to the Museum and Library were announced.

On motion of Hon. A. W. Dodge, the thanks of the Institute were voted to JOHN CUMMINGS, Jr., of Woburn, for the valuable donation of a copy of the text and plates of Girard's "Reptiles of the United States Exploring Expedition."

Mr. E. Bicknell made some remarks on the structure of several kinds of wood, beautifully prepared sections of which were exhibited under several microscopes.

John Pickett, Thomas Pickett, and E. Morrill, of Beverly; and Horace A. Brooks, of Salem, were elected Resident Members.

WEDNESDAY, FEBRUARY 13, 1867. Quarterly Meeting.

Vice President GOODELL in the chair.

William H. Whitmore, William Sumner Appleton, Augustus T. Perkins, and William Frederic Poole, of Boston; Cyrus F. Brackett, of Brunswick, Me.; and George C. Goodale, of Saco, Me., were elected Corresponding Members.

Daniel F. Staten, William Coggsell, William McKean, Samuel A. Lord, N. A. Clarke, and Charles H. Swan, of Salem; Josiah Newhall, of Lynnfield; and William P. Conant, of Wenham, were elected Resident Members.

MONDAY, FEBRUARY 18, 1867. Regular Meeting.

Vice President GOODELL in the chair.

Letters were announced from, — Chicago Academy of Science (Feb. 5); A. D. Brown, Princeton, N. J.; Rev. Samuel Lockwood, Keyport, N. J. (Feb. 6); J. E. Chase, Boston (Feb. 7); John Clark, Boston; J. F. Pickering, Boston; H. C. Perkins, Newburyport (Feb. 9); Prof.

William Hincks, Toronto, C. W.; W. W. Jeffries, West Chester, Pa.; Prof. T. C. Porter, Lafayette College, Pa.; S. I. Smith, New Haven, Ct.; Dr. Benjamin Pickman (Feb. 8); George Scarborough, Sumner, Kansas (Feb. 10); Truman H. Aldrich, Troy, N. Y. (Feb. 12); Moses How, Haverhill; C. R. Robinson, New York (Feb. 18); G. F. Mathew, Cienfuegos, Cuba (Feb. 14); J. W. P. Jenks, Middleboro; G. J. Hadney, Boston (Feb. 15); T. H. Aldrich, Troy, N. Y.; John W. Dean, Boston; T. W. Davids, Colchester, England (Feb. 16); A. D. Brown, Princeton, N. J.; Dr. D. H. Storer, Boston; John Paul, Ottawa, Ill.; A. C. Goodell, Salem; N. E. Atwood, Boston (Feb. 18).

Mr. A. Hyatt made some remarks upon the *Eozoön Canadense*, the earliest known indication of animal life thus far discovered. It is found in the Upper Laurentian formation, which has been hitherto supposed to be of earlier date than the appearance of any life upon the earth. This discovery, establishing as it does the fact of the *aqueous* origin of the rock in which it is found, was considered as an additional proof that beds of rock which have been considered of *igneous* origin are in fact sedimentary origin. This fossil, after careful microscopic examination by Dr. Dawson, of Montreal, was pronounced by him to be a gigantic Rhizopod of the order Foraminifera. Dr. W. B. Carpenter, of London, the great authority upon the Foraminifera, has fully sustained Dr. Dawson in his decision. Mr. Hyatt, in conclusion, said that he had recently had an opportunity to examine this fossil, and saw no reason to doubt its being of animal origin.

Mr. E. Bicknell stated that he had been engaged in preparing some specimens of this fossil, and after a careful examination of these specimens he had no doubt of its being of animal origin, as all the characters described by Drs. Dawson and Carpenter were very plainly seen. He also stated that he had noticed an appearance very much resembling a Marine Alga in the specimens examined by him, but that he was not fully prepared to decide them to be such at the present time.

Capt. N. E. Atwood, of Provincetown, presented some observations on the different species of Whales. He spoke first of the differences between the Porpoise, the Sperm Whale, and the Right Whale and its allies, in which the teeth are so modified as to form baleen, or whalebone. The food was then alluded to. The Sperm Whale feeds principally upon the Squid, or Cuttle-fish. Large specimens of the mandibles of the Cuttle-fish were exhibited, and presented by Capt. Atwood to the Institute. The favorite food of the Right Whale consists of small Crustaceans, Medusæ, and the like. The Finbacks feed on Menhaden and other small fishes. Many times he had observed this species devour at one time large numbers of small fishes.

He then spoke of the relative size of the sexes. The males of the Sperm Whale have yielded as largely as 140 barrels of oil, whereas the

females only yield from fifteen to twenty barrels. Among the Humpbacks the females exceed the males in size. The attachment of the females to the young was also alluded to.

Capt. A. concluded his remarks by giving an account of the capture of the whale, the manner of cutting up and obtaining the oil, and other details of the various operations of the whalers during their cruises.

At the close of Capt. Atwood's interesting address, Mr. Bicknell made a few remarks upon the microscopic structure of the black whalebone, and stated that, in his opinion, in addition to serving as a strainer to catch the food of the whale, the fringe of hairs (with which each blade is furnished on its inner edge) serves as an organ of touch, notifying the whale of the presence of his food. This theory is based upon the fact of the hairs being but the termination of a series of *tubes*, which are continuous from their base to their termination in free ends, and which are filled with a vascular pulp, and which he had no doubt contained nervous substance. The examination of a piece of fresh whalebone would be sufficient to decide the question.

Donations to the Museum and Library were announced.

MONDAY, MARCH 4, 1867. Regular Meeting.

Vice President GOODELL in the chair.

Letters were announced as received from, — J. E. Oliver, Lynn (Feb. 19); B. W. Stone, New York; The Numismatic and Antiquarian Society of Philadelphia; E. W. Buswell, Boston (Feb. 20). Prof. S. Tenney, Vassar College, N. Y. (Feb. 21); John Clark, Cambridge; W. F. Poole, Boston; Hon. J. A. Andrew, Boston; Horace Mann, Cambridge (Feb. 22); H. N. Woods, Rockport; William H. Leggett, New York (Feb. 24); Augustus T. Perkins, Boston (Feb. 25); Hon. J. A. Andrew, Boston (Feb. 26); John Clark, Cambridge (Feb. 27); William S. Appleton, Boston (Feb. 28); C. F. Brackett, Brunswick, Me.; D. L. Adair, Hawsville, Ky.; Capt. N. E. Atwood, Provincetown (Mar. 1); E. T. Strong, West Addison, Vt.; Prof. Theo. Gill, Smithsonian Institution; Thure Kumlien, Bussyville, Wis.; Dr. T. M. Brewer, Boston (Mar. 2); Prof. James Hubbert, St. Francis College, Richmond, C. W.; Prof. H. C. Wood, jr., Philadelphia, Pa.; Dr. Amos H. Johnson, Salem; S. B. Buttrick, Salem (Mar. 4).

Mr. W. P. Upham read a letter written Nov. 30, 1670, by Rev. John Higginson to the Magistrates of the County Court then sitting at Salem, remonstrating against "Mr. Anthony Ashby's being admitted an ordinary-keeper in Salem." "It is to be feared," says the writer, "yt his ordinary-keeping may be a snare to ye looser sort of people in this place & a means to increase drunkenness & prophaneness here, against

which there have not wanted very sad & judicial warnings, as ye drowning of several persons at several times occasioned by their excessive drinking, & others by frequent fuddling & company-keeping undone in their estates," etc. Mr. Upham also read extracts from the records, showing that the remonstrance had the desired effect, and then gave some account of the parties concerned, and of an "Elegy upon the death of Rev. John Higginson," written by his colleague, Rev. Nicholas Noyes.

Mr. G. D. Phippen followed with some remarks upon the poetry and humor of Mr. Noyes, and he then repeated a riddle, composed by him on a visit to one of his lady parishioners, who was busy making a quilt out of bits of fancy silk. The riddle ran thus:—

"I am bespangled and triangled,
With divers colors on;
If every one should go to its home,
I should be quite undone."

Mr. Edward S. Morse called attention to the pair of very large jaws of a cuttle-fish, presented at the last meeting by Capt. Atwood, and made some remarks on the class of Cephalopods, to which the cuttle-fish belongs. He figured on the black-board some of the principal forms; describing the singular structure of the body, and the admirable adaptability of the numerous arms, furnished with suckers, to secure their prey, and the parrot-like jaws of the mouth to tear and devour their food. He stated that in this group we find some of the strangest animals in existence, in many respects showing a high organization. He mentioned the numerous fallacious stories regarding them, and cited Victor Hugo's description of the Devil Fish as one in which the characters of two entirely different animals were thoroughly mixed.

In announcing the donations to the Library, Dr. Wheatland called attention to a volume of Fifth of March Orations, presented by C. W. Palfrey, and offered a few remarks in relation to the event which took place at Boston, March 5, 1770, and which was celebrated there annually, by an oration and other ceremonies, until 1783, when, at a town meeting held March 5, 1783, it was voted to substitute the celebration of the Declaration of Independence for that of the Boston Massacre, after Dr. Thomas Welsh had pronounced the annual oration on the latter occasion.

Donations to the Cabinets were reported by the Superintendent.

John P. Phelps, of Salem, was elected a Resident Member.

The chair called the attention of the meeting to the late donation of one hundred and forty thousand dollars, by Mr. PRABODY for the *Promotion of Science and Useful Knowledge in the County of Essex*, and

read the following Letter and Instrument of Trust by Mr. Peabody, and the reply of the Trustees.

MR. PEABODY'S LETTER.

SALEM, MASS., Feb. 26, 1867.

TO FRANCIS PEABODY, Esq.; Prof. ASA GRAY; WILLIAM C. ENDICOTT, Esq.; GEORGE PEABODY RUSSELL, Esq.; Prof. OTHNIEL C. MARSH; Dr. HENRY WHEATLAND; A. C. GOODELL, Jr., Esq.; Dr. JAMES R. NICHOLS; and Dr. HENRY C. PERKINS:—

GENTLEMEN,—As you will perceive by the enclosed Instrument of Trust, I wish to place in the hands of yourselves, and your successors, the sum of One Hundred and Forty Thousand Dollars, for the PROMOTION OF SCIENCE AND USEFUL KNOWLEDGE IN THE COUNTY OF ESSEX.

Of this, my native County, I have always been justly proud, in common with all her sons, remembering her ancient reputation, her many illustrious statesmen, jurists, and men of science, her distinguished record from the earliest days of our country's history, and the distinction so long retained by her, as eminent in the education and morality of her citizens.

I am desirous of assisting to perpetuate her good name through future generations, and of aiding through her means in the diffusion of science and knowledge; and, after consultation with some of her most eminent and worthy citizens, and encouraged by the success which has already attended the efforts and researches of the distinguished Scientific Association of which your Chairman is President, and with which most of you are connected, I am led to hope that this gift may be instrumental in attaining the desired end.

I therefore transmit to you the enclosed Instrument, and a check for the amount therein named (\$140,000), with the hope that this Trust, as administered by you and your successors, may tend to advancement in intelligence and virtue, not only in our good old County of Essex, but in our Commonwealth, and in our common country.

I am, with great respect,

Your humble servant,

(Signed)

GEORGE PEABODY.

INSTRUMENT OF TRUST.

I hereby give to FRANCIS PEABODY, of Salem; ASA GRAY, of Cambridge; WILLIAM C. ENDICOTT, of Salem; GEORGE PEABODY RUSSELL, of Salem; OTHNIEL C. MARSH, of New Haven, in the State of Connecticut,
 PROCEEDINGS ESSEX INST., VOL. V. 15 OCT., 1867.

ticut; HENRY WHEATLAND, of Salem; ABNER C. GOODELL, jr., of Salem; JAMES R. NICHOLS, of Haverhill; and HENRY C. PERKINS, of Newburyport, the sum of One Hundred and Forty Thousand Dollars, to be by them and their successors held in trust, for the promotion, among the inhabitants of my native County of Essex, of the Study and Knowledge of the Natural and Physical Sciences, and of their application to the Useful Arts.

And I empower my said Trustees to make all such arrangements and agreements with the Corporation now established in the City of Salem under the name and title of the Essex Institute, as may be necessary or expedient for carrying into effect the provisions of this instrument.

I direct that the sum of Forty Thousand Dollars, of the amount I have above given, shall be applied to the purchase of land in the City of Salem, the purchase of the East India Marine Hall, and the erection, fitting up, and furnishing of such buildings thereon as shall be necessary for the purposes of this Trust.

I further direct that the remaining sum of One Hundred Thousand Dollars be forever kept invested by my said Trustees and their successors as a permanent Fund, and only the income thereof be used for the purposes of this Trust.

In case the before-mentioned sum of Forty Thousand Dollars shall be found insufficient, this income may be applied to the purpose of erecting such buildings as have been mentioned, the furnishing and arrangement of museums and collections, or such similar purposes as in the judgment of the Trustees shall be necessary to place the Institution on a proper basis for the benefit and instruction of the public; and it is my desire that the work of arranging a Museum and Collections be entered upon at an early day, and proceeded with as rapidly as can be done conveniently and advantageously.

After this shall have been done, the income shall be applied in the following proportions: — Seven-twelfths thereof to the department of the Physical Sciences and Practical Technology, and Five-twelfths thereof to the department of the Natural Sciences; but the Trustees, if after sufficient experience they shall find it desirable, may change these proportions, and, if at any time hereafter they shall be unanimously agreed upon the expediency of so doing, they may change the application and direction of the whole of said income as they may deem most conducive to the interest of Science and Learning in the County of Essex.

All vacancies in the Board of Trustees above constituted, by death, resignation, or otherwise, shall be filled, as soon as conveniently may be, by vote of the remaining Trustees.

The Trustees shall keep a record of their doings, and shall annually prepare a report setting forth the condition of the Trust and Funds, and the amount of income received and expended by them during the previous year. This report shall be signed by the Trustees, and made public in such manner as they shall think expedient.

I give to said Trustees the liberty of obtaining from the Legislature an Act of Incorporation, if they shall deem it desirable; to make all necessary By-laws, and all such regulations and restrictions as shall be necessary, in their judgment, for the preservation and maintenance of the Trust, and of all property or collections held under it; and generally to do whatever may be proper and necessary to carry into effect the provisions of this Trust.

I am, with great respect,

Your humble servant,

GEORGE PEABODY.

(Signed)

REPLY OF THE TRUSTEES.

SALEM, MASS., March 2, 1867.

GEORGE PEABODY, Esquire:—

SIR,—We have the honor to acknowledge the receipt of your letter of the 26th of February, and the accompanying Instrument of Trust; and while fully appreciating this evidence of your confidence, and deeply sensible of the honorable and important duties we assume, we accept the appointment of Trustees of the sum of One Hundred and Forty Thousand Dollars, placed in our hands by you for the promotion of Science and Useful Knowledge in the County of Essex.

So wise and munificent a gift cannot fail to advance the general interests of sound learning, and to be productive of vast benefit to the people of this County.

The announcement will fill their hearts with the deepest sense of gratitude, not unmixed with pride, that the giver is one of themselves, born and educated upon their soil. They will read with pleasure your kind allusions to them, and your reference to the many illustrious sons of Essex, whose memory they cherish with tender regard.

And while you would perpetuate to future generations the good name of the County of Essex, be assured that yours will be cherished by her people, and be handed down to their children, not only as among the most distinguished of her sons, but as among the great benefactors of mankind.

On their behalf, and in behalf of the great cause of science and letters for which you have everywhere done so much, we tender most cordial thanks.

We shall endeavor to manifest our full appreciation of the trust given us, by faithfully carrying out the objects and views which you have so clearly set forth.

In performing these duties, we trust that we may have the benefit of your counsel and advice. And we earnestly hope that you may long live to witness your good work, and that you may see accomplished all that you desire and intend by founding so beneficent a Trust.

With great regard, we remain,

Your obedient servants,

(Signed)

FRANCIS PEABODY,
ASA GRAY,
WM. C. ENDICOTT,
GEO. PEABODY RUSSELL,
OTHNIEL C. MARSH,
HENRY WHEATLAND,
ABNER C. GOODELL, Jr.
JAMES R. NICHOLS,
HENRY C. PERKINS.

F. W. PUTNAM, Superintendent of the Museum, introduced the following Resolution : —

Resolved, — That the Institute has learned with feelings of gratitude and pleasure the fact of the munificent donation of \$140,000 by George Peabody, Esq., for "the promotion, among the inhabitants of the County of Essex, of the study and knowledge of the Natural and Physical Sciences, and of their application to the Useful Arts;" and while, as citizens of this county, the members of the Institute are justly proud that this donation comes from a native of the county, they are most deeply sensible of the honor conferred upon their body by its being selected as the Institution with which the Trustees of this fund are to coöperate in securing the objects of the donor.

Dr. GEORGE B. LORING, in seconding the Resolution, spoke substantially as follows : —

Mr. President, — I have been unable, owing to the pressure of business, and the multiplicity of my avocations, to attend the meetings of the Institute this winter, according to my usual custom. I was not aware, when I found leisure to be present this evening, that I should find here so pleasant an occasion; and I congratulate myself that I have been so fortunate as to be one of the first listeners to the announcement of Mr. Peabody's generous donation to this Association.

I have always been impressed with the thought, Mr. President, that great men are the impersonation and embodiment of the spirit of the times in which they were born, and of the peculiar genius of the locality which they could claim as their country and their home. Human greatness consists especially in this; and be he statesman or warrior or poet or philosopher or benefactor, the great and representative man is he who is guided and developed by this law. You find in Shakespeare all that is grand and profound in the English drama; you find

in Milton all that is lofty and sublime in that English poetry which grew out of an endeavor for popular freedom in an early day; you find in Washington all the high qualities of patience, courage, wisdom, and sagacity, which gave the American people the civil and military power to found a free republic. And so the man who establishes a government, or develops a philosophy, or builds up and uses his fortune, in violation of the spirit of the age in which he lives, serves only as a warning to his fellow men, and fails in his mission here on earth.

Now, sir, when I contemplate the character of that distinguished man, whose greatness consists in the judgment and wisdom with which he bestows his bountiful benefactions, I am always struck with the fact that in him are combined all those qualities of prudence, honesty, industry, and thrift, which so truly belong to the town in which he was born, and also that devotion to all those institutions of learning, religion, and charity, which lie close to the hearts of our people. GEORGE PEABODY is the embodiment of the best industry, and the soundest practical philanthropy of New England Society. What the associated men of his native town of Danvers have labored for, for years, he has accomplished better than they all. And what a remarkable picture he presents! He commenced life here as a poor boy. He had no superior advantages. He could call upon no powerful family for aid. He was born into no great mercantile line, in whose well-beaten path he could travel on to fortune. He inherited from his father and mother only the faculties which he himself was to use in carving out his own career. And it is astonishing how, as he went forth into the world, he preserved, even in the height of all his successes, these native faculties unharmed. He has been debauched by none of the temptations which great wealth and unbounded prosperity carry in their train.

Passing from his own country into the great commercial centre of the world, he has preserved all his habits of industry, all the method of his early life, and all the simplicity and frugality into which he was born. He has boasted of no establishment; he has taken no pride in his equipage; has not made himself conspicuous with his horses in the parks and on Regent street; has courted no titles; has asked for no distinction. But exercising always a generous hospitality toward his countrymen, he has been content to bestow his fortune and his powers upon the wisest charities. In his simple counting-room, from which his sagacious eye has surveyed the business of the world, on the London Exchange, and in all private and public duties, he has always kept that identity with which he started in life. His large brain, broad enough for the best human service, ample enough for a statesman, has never yet been turned from that course which he laid out for himself in the beginning; and George Peabody of London is simply George Peabody of Danvers, developed by time and experience into all his ample proportions.

I think, sir, to have received the attentions of a man like this is an honor as well as a benefit to our institution. You must have observed that Mr. Peabody bestows his benefactions on worthy objects, with judgment entirely equal to his generosity. He puts the bounties of princes and nobles to shame, by his great appropriation for the poor of London. He builds up institutions of learning and religion in his own land, extending his charity, with a full hand, to the dark spots desolated by rebellion and war. Libraries and schools spring up un-

der his touch. He erects no glittering monuments, objects of popular curiosity, — but moves always for the education of mankind, for their religious culture, and for the relief of their suffering and sorrow. He says “no” with all the wisdom laid down in that remarkable discourse of our own President Walker; and he says “yes” with that unerring judgment and prudence, which have thus far enabled him to avoid unworthy objects. And when I remember the labor which has been bestowed upon this Institute without money and without price, the devotion which has characterized those who carried it for years in their arms, and have cherished it to manhood, I cannot be too grateful to him who has now included it among the objects worthy of his encouragement and benefaction. The Essex Institute has now been enrolled among the best institutions in our land by the bounty of George Peabody. They who have looked upon us heretofore as an association of “bug-hunters,” may remember this. They who have looked upon our field-meetings as mere excursions into the woods and among the pleasant valleys of our County, may remember this. And they will find that the bounty of Mr. Peabody has been bestowed upon an institution engaged in the most careful scientific exploration, in investigating the wonders of nature wherever found, in opening leaf by leaf the great volume, in gathering up and preserving all the historical incidents of our locality and country, and the story of our great men.

In coming to our aid, Mr. Peabody has done one more act to enrol his name among those distinguished men of old Essex, whose record we would here enshrine. I know not, sir, when or by whom the work is to be done; but I trust we shall one day see that volume in which the lives of these men and their great services will be immortalized — of Higginson and Peters and Woods and Stuart in theology; of Parsons and Story and Dane and Gerry in the law and jurisprudence and statesmanship; of Prescott among the historians; of Whittier among the poets; of Hawthorne, the greatest of all in the philosophic mysteries of romance, the genius of this sombre spot; of the merchants and benefactors who stand forth in our local history in long array. The interest of such a work as this it is hard to estimate. To us of the Essex Institute how is this interest increased by the fact, that foremost among them all will stand the name of GEORGE PEABODY, our benefactor and friend.

Mr. President, I most cheerfully second the appropriate resolution of Mr. Putnam; and in order to give full force to the event which has placed the Essex Institute on a firm foundation, I would also move that a committee be appointed to arrange becoming ceremonies for the inauguration of this new era in the life of our association.

The resolution was then unanimously adopted, and, on motion of Dr. Loring, it was voted that a copy thereof be communicated to Mr. Peabody.

The following resolution was then adopted: —

Resolved, — that a committee of seven members of the Institute be appointed to confer with the Trustees of the fund of \$140,000 given by George Peabody, Esq., for the promotion of science and useful knowledge in the county of Essex, to receive any proposals from said Trustees, and to report thereon, as well as to report any plan for future action, in view of carrying out the wise and laudable purposes of the

donor, and further to report such plan as they deem proper for celebrating this epoch in the history of the Institute.

Messrs. F. W. Putnam, G. B. Loring, Charles Mansfield, R. S. Rantoul, W. P. Upham, Henry M. Brooks, and Alpheus Hyatt were elected as the Committee of conference.

MONDAY, MARCH 18, 1867. Regular Meeting.

Vice President GOODELL in the chair.

Letters were announced from,—Rev. A. B. Kendlg, Davenport, Iowa; Benjamin W. Stone, New York; Capt. N. E. Atwood, Provincetown; Dr. James R. Nichols, Boston; Major R. S. Williamson, U. S. A., San Francisco, Cal.; E. T. Cresson, Sec'y American Entomological Society; James M. Barnard, Boston; W. A. Haines, New York; Dr. Samuel A. Green, Boston (March 8); Charles H. Higbee, Salem (Mar. 9); Dr. Daniel Clark, Flint, Mich.; A. H. Curtiss, Liberty, Va.; Surg. Elliott Coues, U. S. A., Columbia, S. C. (March 10); John Bolton, Portsmouth, Ohio; John Jenkins, Monroe, N. Y.; J. J. Babson, Gloucester; L. Disturnell, New York (March 14); Dr. W. H. Gregg, Elmira, N. Y.; Prof. A. E. Verrill, Yale College; Samuel L. Boardman, Augusta, Me.; Rev. E. C. Bolles, Portland, Me. (March 16); S. Russell, Boston; T. McIlwraith, Hamilton, C. W.; W. H. Leggett, New York; Dr. William Stimpson, Sec'y Chicago Acad. Sciences; S. S. Fowler, Danvers (March 18).

Mr. F. W. Putnam gave an account of the present state of knowledge regarding the *Trichinæ* in pork, a piece of pork infested with this worm having been presented to the Institute by Dr. J. W. Sawyer, of the Butler Hospital.

Mr. Goodell presented in the name of Joseph S. Leavitt, of Salem, an Indenture on parchment, made the eleventh day of September, Anno Domini one thousand seven hundred, and "in the twelfth yeare of the reigne of our sovereigne Lord Willam the Third," between "Charles Downing, of London, in the Kingdom of England, Esq., of the one part, and Thorndike Proctor, of Salem, in the County of Essex within his Majesties Province of the Massachusetts Bay in New England in America, yeoman, on the other part, witnessing that the said Charles Downing conveys land in Salem to said Thorndike Proctor." Mr. Goodell gave a brief history of the Downing family. The Charles above mentioned was son of Sir George, Bart. (son of Emanuel, of Salem), who was partly prepared for college by Rev. John Fisk, and graduated in the first class of Harvard College, 1642, went to England, got in favor with Cromwell, and rose to high distinction. The land conveyed by the above Indenture was the original grant from the town to Robert Cole,—and by him conveyed to Emmanuel Downing. It was situated where Proctor's Crossing now is, in South Danvers.

The secretary read a communication from Rev. E. C. Bolles, of Portland, Me., accompanying a valuable and highly interesting collection of manuscripts, pamphlets, etc. Mr. B.'s letter was as follows:—

To the Essex Institute:—

While on a lecture tour a few weeks since, I visited a large paper-mill for the purpose of examining the mass of pamphlets, books, and manuscripts, that in such places is continually undergoing "reconstruction." I was just in time; for the "sorters" had not been many minutes engaged on a bale of papers that proved to be the *debris* of the study of the late Dr. J. L. Riddell, of New Orleans. It was evident, that some executor, neither literary nor scientific, had bundled off this accumulation at the current price of paper-stock, in clearing out the huge many-pressed room, in which, as I well remember, Dr. Riddell was wont to sit at the Medical Department of the University of Louisiana, surrounded by the rarest and direst confusion of all things surgical, microscopical, chemical, and often diabolical. From this bale and one discovered afterwards, I rescued many articles of interest and value. I have already transmitted various pamphlets, Dr. R.'s medical diploma, etc., and now I beg to send the accompanying manuscripts with the following remarks.

You will find among the pamphlets a "*jeu d'esprit*" of Dr. Riddell's entitled "Orrin Lindsay and his System of Aërial Navigation—with an account of his Voyage around the Moon." The papers are the sketches and preliminary calculations for that amusing essay. They include also the notes for a projected Trip to the Planet Mars, also supposed to have been made by the same mythical Lindsay. They are interesting as showing the great care and labor demanded to express this little story of a lunar excursion in terms of strict scientific accuracy, to make the whole seem probable in the precision of every number and calculated force, and to leave no chance for the fault-finding of the most accomplished critic, save with the monstrous assumption that gravity may be overcome by a new law of magnetic exclusion. I think you will find the printed essay well worth reading in connection with this unexpected commentary which Dr. Riddell is made to furnish to his own work.

Such a view behind the scenes gives us, too, no bad idea of the author. If his private character was marked by a peculiar avarice seldom found among scientific men of so high a grade, yet his natural restlessness and industry cannot be too much extolled. As all his private letters, literary notes, duplicate publications, and microscopical drawings seem to have been included in the collection of which I examined a part, it is probable that but few evidences of his many years of strange but faithful studies remain to interest the thoughts and employ the pen of the antiquarian.

E. C. BOLLES.

A specimen of the Hair-worm (*Gordius aquaticus*) having been presented, Mr. Putnam gave an account of the habits of the worm, and alluded to the absurd notion that was prevalent, that these worms were developed from horse-hairs which had been some time in water.

Donations to the Museum and Library were announced.

Mr. Putnam called attention to the *AMERICAN NATURALIST*, an Illustrated Monthly Magazine of Popular Natural History, the first number

of which was on the table, having recently been issued from the Institute Press, under the editorship of four of the officers of the Institute.

Ira K. Mansfield, of Salem, and Joseph Appleton, of Beverly, were elected Resident Members.

*Additions to the Museum and Library during January,
February, and March, 1867.*

TO THE NATURAL HISTORY DEPARTMENT.

BY DONATION.

ALLEN, J. F., Salem. Specimens of *Pyrharctia Isabella* Packard, *Allyia octo-maculata* Smith, and Grape-vines bored by Insects.

ANGUS, JAMES, West Farms, N. Y. A collection of Insects from West Farms, New York.

ATWOOD, Capt. N. E., Provincetown. Three plates of Baleen; an Eye Socket of a Sword-fish; the Beaks of a large Cuttle-fish, from the North Atlantic; Beaks of Cuttle-fish and a piece of Sponge, from Provincetown.

BOARDMAN, GEORGE A., Milltown, Me. Hoof of a Caribou; Cutting Teeth, Hind and Front Foot and Tail of a Beaver, and several other specimens, from Nova Scotia.

BREWSTER, C. G., Boston. A small collection of Fossils from various localities.

BROWNE, A. G., Salem. Stones of second crop Peach, from S. E., Georgia, picked in August.

BURCHSTEAD, GEORGE, Hamilton. Red-tailed Hawk, from Hamilton.

CARLEN, SAMUEL, Salem. Specimens of Lesser Red Poll, *Egiothus linarius*; of the Yellow Bird, *Chrysomitris tristis*; and four specimens of Snow Bunting, *Plectrophanes nivalis*, from Salem; two heads of American Hare.

CHEVER, Capt. WILLIAM J., Andover. Salamander, taken from a well in Grafton, N. H.

CLOUTMAN, JOSEPH P., Salem. Minerals and Ores, from the Gregory Mine, Colorado.

COOKE, C., Salem. Parasites from the gills, stomach, and intestines of the Pickerel; a White Rat (male), about twenty-two months old.

COOLEGE, JAMES, Salem. Two specimens of *Tropidonotus* sp., from Han Kou, China; *Holothurian*, from China; specimen of Coral, from Kan Loong, China; Seeds of Lichees and other Fruits, from China; Arsenical Ore and Bituminous Coal, from the interior of China; specimens of Gypsum, from Han Kou, China; Antimonial Ore and several other Minerals, from various localities in China.

COOPER, EUSTICE, J., Mineral Point, Wis. A collection of Minerals, from Mineral Point.

GROVER, WILLIAM, Salem. Four specimens of *Leda tenuisulcata*, and one of *Yoldia thraciæformis*, from stomachs of Sand Dabs, from Salem harbor.

HERSEY, Miss IRENE G., South Boston. Insects, from Havana, Cuba.

JOHNSON, THOMAS H., Salem. Specimen of Little Screech Owl, from Salem.

KEMBLE, Dr. A., Salem. Specimens of Morbid Anatomy.

KINSMAN, N. J., Salem. Specimens of *Limax flavus* and *L. variegatus*, from Salem.

LINCECUM, Dr. G., Long Point, Texas. Two alcoholic specimens of *Buthus Carolinensis*, from Long Point; Insects, Land Shells, and Seeds of *Erythrina sp.*, from Texas.

LORD, Capt. S. A., Salem. A specimen of the Nut of *Lodoicea Seychellarum*, Sea Coco, from the Seychelles Islands.

NASON, Dr. W. A., Chicago, Ill. Specimens of Reptiles, Fishes, Crustaceans, and Insects, in alcohol; also a collection of recent and fossil Shells from various localities in Illinois.

NORRIS, W. E., Salem. Prepared skin of Kingfisher; also several shells, from Fort Macon, Beaufort, North Carolina.

PACKARD, A. S., jr., Salem. Three specimens of Larva of *Dasylophia anguina*, from Boston, comprising two stages of growth.

PICKMAN, Dr. B., Boston. A collection of Fishes, Reptiles, etc., from Lake Champlain. Collected by GEORGE AVERILL.

ROBERTS, DAVID, Salem. Skull and Skin of Hare, from Wenham.

ROGERS, B. F., Salem. Five Fœtal Pigs. forty-seven days old.

ROWE, JOSEPH, Salem. A collection of various specimens, from several localities.

SANDERS, THOMAS, Salem. Head of thorough bred Merino Lamb.

SAWYER, Miss, Salem. Specimen of *Gordius aquaticus*, from Salem.

SEARS, JOHN H., Danvers. Two specimens of Pine Grossbeak, *Pinicola Canadensis*, from Danvers, and a specimen of Iron Slag.

STRONG, E. F., West Addison, Vt. A collection of Fossils from the limestone on the banks of Lake Champlain, at Addison.

ST. JOHN, J. A., Boston. Specimens of *Vermetus*, from the Island of St. Lucas.

SYMONDS, G. W., and DODGE, FRANCIS, Salem. A collection of Shells and Minerals, from various localities.

WALKER, SAMUEL L., Salem. Young Flounder, *Platessa ferruginea*; Young Lobsters, *Homarus Americanus*, from Lobster Rocks, Beverly harbor, and a piece of Sponge from Beverly harbor.

WHITE, G. M., Salem. A collection of Insects, from the vicinity of Salem.

TO THE HISTORICAL DEPARTMENT.

BY DONATION.

BAILEY, DAVID, North Beverly. An ancient Water Horn.

COOLEGE, JAMES, Salem. Two Bricks from the Porcelain Tower at Pekin.

DABNEY, Miss MARGARET, Salem. A Portrait of Dr. Nathaniel Dabney.

DAY, SAMUEL, Salem. Ancient Spoon, found at Ipswich Beach.

DODGE, Hon. A. W., Hamilton. An ancient Spoon, found at Hamilton.

PINNOCK, THOMAS, Salem. Portion of an Indian Stone Gouge, dug up in South Salem.

PRESTON, NEHEMIAH, Beverly Farms. An Indian Stone Gouge, found in Wenham, near the line of Beverly Farms.

SYMONDS, G. W., and DODGE, FRANCIS, Salem. Various Historical Relics.

TO THE LIBRARY.

BY DONATION.

ALLEY, JOHN B., M. C. Report U. S. Revenue Commission, 1865-6, 1 vol. 8vo, Washington, 1866. Report on the Assassination of Lincoln, 8vo, pamphlet, July, 1866. Report on the Memphis Riots, 8vo, pamphlet, July, 1866. Wells's Report on the Revenue, Dec., 1866, Pub. Doc. Papers relating to Mexico, 8vo, pamphlet, U. S. Doc. Digest of Laws relating to Duties on Imports to July 28, 1866, 8vo, pamph., Washington. Report on New Orleans Riots, 8vo, pamph., U. S. Pub. Doc., Washington, 1867. Report of Com. of Bureau of Refugees, etc., 8vo, pamph., U. S. Pub. Doc., Washington, 1867. Message and Documents Department of State, pt. 1, 1865-6, 2 vols. 8vo, Washington, 1866. Department of Agriculture Report, 1864, 1 vol. 8vo, Washington, 1865. Patent Office Report, 1864, 2 vols. 8vo, Washington, 1866. Congressional Globe for First Session, Thirty-ninth Congress, 1865-6, 5 vols. 4to, Washington. Eighth Census, U. S., Mortality and Miscellaneous Statistics, 1 vol. 4to, Washington, 1866.

APPLETON, JOHN, Boston. Monumental Memorials of the Appleton Family, 1 vol. 4to, Boston, 1867.

BAKER, GEORGE, Providence, R. I. Wigglesworth's Sermon on the death of Rev. John Rogers, Jan. 5, 1745, 8vo, pamph., Boston, 1746. Dana's Discourse at Ipswich, July 4, 1827, 8vo, pamph. Dana's Dis-

course on Washington, at Ipswich, Feb. 22, 1800. Frishie's Discourse on Washington, at Ipswich, Jan. 7, 1800. Rogers' Discourse on S. Williams, at Ipswich, 1763. List of the South Parish (Ipswich) Tax, 1750 (Mss.).

BARNARD, J. G. Barnard's Eulogy on Brevet Major Joseph G. Totten, 8vo, pamph., Washington, 1866.

BATCHELDER, JOHN H. Manual of General Court of Massachusetts. 8vo, pamph., Boston, 1866. Massachusetts Election Sermon, by A. H. Quint, 8vo, pamph., Boston, 1866.

BEMIS, LUKE, Boston. History of Abington, by Benjamin Hobart, 1 vol. 12mo, Boston, 1866.

BOARDMAN, SAMUEL L., Augusta, Me. Acts and Resolves of Maine, 1860-1866, 7 vols. Journal of Senate, Maine, 1866, 1 vol. 8vo. Report of Board of Education, Maine, 1847-52, 1 vol. 8vo. Maine Register, 1841, 1 vol. 16mo, Augusta, 1841. Bangor Directory, 1855, 1 vol. 16mo, Bangor, 1855. 24 Pamphlets.

BOLLES, E. C., Portland, Me. Portland Almanac and Register, 1860, 1 vol. 16mo. Lewiston and Auburn Directory for 1860 and 1864, 2 vols. 12mo. Geer's Hartford Directory for 1859-60, 16mo. 1 vol., Hartford, 1859. Canada Directory for 1857-8, 1 vol. 8vo, Montreal, 1857. 14 Town Reports. 11 Nos. Siderial Messinger. 37 Connecticut State Documents, pamphlets. Bangor Directory, 1843, 1848, 1855, 1859-60, 4 vols. 16mo. Hutchinson's Nova Scotia Directory for 1864-5, 1 vol. 8vo, Halifax, 1864. Whipple's History of Acadie, etc., 1 vol. 8vo. Bangor, 1816. Bangor City Documents, 9 pamphlets, 8vo. Portland City Documents, 27 pamphlets, 8vo. Maine State Documents, 34 pamphlets, 8vo. 176 Miscellaneous pamphlets. Cohen's New Orleans Dictionary for 1849 and 1859, 2 vols. 8vo, New Orleans, 1848 and 1858. Proceedings of American Association of Science, sixth meeting, 1 vol. 8vo, Washington, 1852. Mss., etc., formerly belonging to Prof. John L. Riddell, of New Orleans.

BROOKS, HENRY M. Scientific American, 138 numbers. 20 Pamphlets.

BROWNE, A. G. Savannah Republican for 1808, 1 vol. folio.

CHASE, GEORGE C. The Friend, 14 numbers.

CHENEY, T. A., Watkins, N. Y. Transactions of N. Y. State Agricultural Society for 1852 and 1864, 2 vols. 8vo, Albany. Transactions of American Institute for 1864, 1 vol. 8vo, Albany. Twenty-first Annual Report of Public Schools of Rhode Island, 1 vol. 8vo, Providence, 1866. Jenkins' Life of Silas Wright, 1 vol. 12mo, Auburn, 1849. 25 Pamphlets.

CLAPP, Rev. D. Memorial of the Reunion of the Natives of Westhampton, Mass., Sept. 5, 1866, 8vo, pamphlet, Waltham, 1866.

COLE, Mrs. N. D. Salem Gazette for 1866, 1 vol. folio. Boston Daily Evening Traveller for 1866, 2 vols. folio.

CONES, ELLIOTT, Asst. Surg. U. S. Army. Osteology and Myology of *Colymbus torquatus*, by E. Cones, M. D., etc., 4to, pamphlet, Cambridge, 1866.

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MONDAY, APRIL 1, 1867. Regular Meeting.

Vice President GOODELL in the chair.

Letters were announced from, — Smithsonian Institution; The Numismatic and Antiquarian Society of Philadelphia; New York Lyceum of Natural History; Buffalo Historical Society; Library of Congress; Trustees of Beverly Public Library; The Corporation of Harvard College (March 19); J. A. Smith, Bethel, Me.; J. T. Rothrock, McVeytown, Pa.; Presbyterian Historical Society; William L. Montague, Lib. at Amherst College; Rev. E. C. Bolles, Portland, Me. (March 21); Dr. Lincoln R. Stone, Newton; J. P. Haskell, Marblehead (March 22); Tryon Reakirt, Philadelphia, Pa.; Francis B. Crowninshield, Boston (March 23); R. Hoe & Co., Boston (March 24); Boston Society of Natural History (March 25); Buffalo Historical Society (March 26); E. T. Cresson, Sec'y American Entomological Society; William J. Turnbull, Philadelphia; Capt. Samuel A. Lord, Salem (March 28); Francis B. Crowninshield, Boston (March 29); Prof. Theo. Gill, Smithsonian Institution; W. H. Leggett, New York (March 30).

Mr. William P. Upham read certain extracts from records of wills, deeds, etc., bearing upon the question whether the Epps or Newhall house, so called, on the corner of Church and Washington streets, is, as has been supposed, the original house that belonged to Governor Endicott, and was brought from Cape Ann for his use. This house has been frequently referred to in our local histories, and, as the correctness of the tradition relating to it had been called in question, it was thought proper to collect all the evidence that could be found on the subject. Mr. Upham read copies of and explained the different deeds of land in that vicinity from the earliest date, and it appeared quite conclusively, by this and other evidence, that the Governor's house did not stand on this precise spot, but about ten rods north of it, where Federal street enters Washington street from the east, and that there is good reason to believe that the original house was moved

about 1679 from there directly south to the site it now occupies. The following is a brief statement of the evidence :—

The precise locality where the Newhall house now stands was, as far back as it can be traced, a yard belonging to the house of Thomas Oliver who lived where Dr. S. M. Cate now lives. The land to the north and east of this between Washington and St. Peters streets, and extending north so far as to include the estate now occupied by Eleazer Hathaway, baker, was first owned, so far as our records show, by Governor Endicott, and was known as the "Governor's Field," or "Endicott's Field." In two conveyances of the land next north of the "Governor's Field," one dated Jan. 28, 1658, and the other March 10, 1659, it is described as "on the South, bounded by the *house* and land of Mr. Endecott." The Inventory of Gov. Endicott's estate mentions "a House at the toun^e wth 3 acres of land belonging to it — — £100." The "Governor's Field" consisted of about three and a half acres. By the Commoners' Records it appears that in 1714 a share in the "Commons" was assigned to Major William Browne for "Governor Endicott's Cottage Right in Town." Therefore Major Wm. Browne must have owned in 1714 the land whereon stood a dwelling-house of Gov. Endicott's before 1661. The only land then owned by him to which this could apply was half an acre where Federal street now enters Washington street, which was bought by him of the heirs of Gov. Endicott, March 3, 1686, no house being mentioned in the deed.

The ground where the Newhall house now stands was sold by Thomas Oliver to Robert Gray, Jan. 11, 1668; and bought by Daniel Epps, April 16, 1679, at which time there was evidently no house on it; this is shown not only by the absence of any mention of a house in the deed, and by the price paid for it, but also by the manner in which possession was given, namely, "by turf and twig," according to the custom of that time in conveyances of land alone. (See Blackstone, II. 315.) About the same time the whole of the "Governor's Field" was sold to different parties, but no mention is made of any house on it in either of the deeds. We can hardly suppose that a house in which the Governor had lived so short a time before could have already fallen to decay, neither is it probable that it could have been destroyed by fire, as some mention would have been made of it. The tradition has been unbroken (see Essex Inst. Hist. Coll., Vol. II. p. 39, notice of the "Old Planter's House") that this same house which now stands on the northern corner of Church and Washington streets was Gov. Endicott's house. We may then reconcile this tradition with the record evidence, and very reasonably conclude that after Gov. Endicott's death, none of his family living in town and there being no need of a dwelling-house there, it was sold to Epps, and moved by him to the site it now occupies.

Mr. Upham showed a drawing representing the appearance of the nails found in an oak beam in the cellar of this house, supposed to represent the initials of John Endicott, and referred to as corroborating the tradition. The beam is part of the original frame of the house, and runs across the middle of the cellar parallel with the front of the house, and is of solid oak, one foot square. These nails must have been driven in when the wood was green, for they are wholly embedded in it, while it would be impossible to drive any nail into the wood now at all. The following will give some idea of the relative position of the nail heads, the face of the beam being smooth and free from any other mark near them.

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The above is about one-third size. Turned upside down it will stand, perhaps, for I E. It would be difficult to assign any other object for driving these large nails into such a beam, except for a mark of ownership, and they resemble nothing more nearly than the initials of John Endicott, for which they have always, according to tradition, been supposed to be intended.

Remarks on the same subject were made by Messrs. J. C. Osgood, G. D. Phippen, and others. The terms of "cottagers," "commoners," and "cottage rights" having been used in the course of the remarks of the several speakers, Mr. Upham gave an account of the origin of the Common and Cottage Rights, so called, and showed how a proper understanding of them, and a study of the Commoner's Records enables us to determine many interesting points in local history especially relating to the location of the earliest dwellings.

Donations to the Museum and Library were announced.

Daniel James Tapley, and S. P. Cummings, of Danvers; and F. Margoles, Everett E. Austin, Stephen Gauss, and George P. Fowler, of Salem, were elected Resident Members.

MONDAY, APRIL 15, 1867. Regular Meeting.

Vice President GOODELL in the chair.

Letters were announced from, — James M. Barnard, Boston; Prof. W. P. Blake, San Francisco, Cal.; W. P. Conant, Wenham (Mar. 30); Rev. E. C. Bolles, Portland, Me.; Brevet Maj. Gen. Barnard, U. S. A.,

New York; J. M. Currier, Newport, Vt.; Charles Moulton, Newburyport; W. W. Denslow, New York; J. E. Oliver, Lynn; G. F. Matthews, St. John, N. B. (April 8); Prof. P. A. Chadbourn, Williams College; C. C. Beaman, jr., Washington; John F. Miboy, New York; Buffalo Historical Society (April 8); R. E. C. Stearns, San Francisco, Cal.; Clarence King, U. S. Geologist, New Haven, Ct.; Massachusetts Historical Society; J. Munsell, Albany, N. Y. (April 10); W. E. Endicott, Canton; Minnesota Historical Society; Josiah Newhall, Lynnfield; John C. Holmes, Ypsilanti, Mich. (April 18); J. A. Allen, Springfield (April 14); S. P. Cummings, Danvers; Buffalo Historical Society (April 15).

Mr. T. Ropes gave a brief account of the schools existing in Salem about the year 1810, especially the one kept by "old Master Hacker." Considerable discussion then ensued relating to the History of Education in Salem during the past fifty years.

Donations to the Museum and Library were announced, and remarks were made on several of the specimens by Messrs. Hyatt, Putnam, and Morse. Mr. Morse, in speaking of a collection of shells received from Calcutta, gave a general outline of the class of Mollusca and sketched the soft parts of many of the species of shells represented in the collection.

N. H. Eaton, Dean Stiles, Walter J. Norfolk, James T. Tucker, and Justin Hinds, of Salem; and Edward P. Colby, of Beverly, were elected Resident Members.

MONDAY, MAY 6, 1867. Regular Meeting.

Vice President GOODELL in the chair.

Letters were received from, — Copley Amory, Boston; J. A. Allen, Springfield; J. Wingate Thornton, Boston (April 17); E. L. Layard, Director South African Museum, Cape Town; John A. Loring, Boston; J. W. Thornton, Boston; Maine Historical Society; S. G. Drake, Boston; E. P. Marvin, Boston (April 19); Lyceum of Natural History of Williams College; Rev. Samuel Lockwood, Keyport, N. J.; W. W. Denslow, Inwood, N. Y.; Rev. A. B. Kendig, Davenport, Iowa; Rev. E. C. Bolles, Portland, Me. (April 20); W. A. Smith, Worcester; Historical Society of Pennsylvania (April 22); W. D. Morgan, New York; J. K. Wiggan, Boston (April 25); Dr. T. M. Brewer, Boston; Mrs. L. A. Swazey, Salem; E. W. Buswell, Boston (April 26); E. P. Marvin, Boston (April 27); C. P. Preston, Danvers (April 28); J. A. Allen, Springfield; T. McIlwraith, Hamilton, C. W.; Dr. T. M. Brewer, Boston (April 29); S. Jillson, Hudson (May 2); J. A. Allen, Springfield; Prof. A. E. Verrill, Norway, Me.; T. T. Richards, St. Louis, Mo. (May 3); J. A. Allen, Springfield (May 6).

A letter from William D. Morgan, Esq., of New York city, was read, stating, that, at the request of Mr. George Leslie, of London, son of the late Charles Robert Leslie, R. A., he had forwarded to the Essex

Institute a picture painted by Mr. Leslie, representing a scene in English History during the Wars of the Roses, entitled "The War Summons." Mr. Leslie desired the picture to be presented as a mark of his esteem for the talents of the late Nathaniel Hawthorne.

The thanks of the Institute were presented to Mr. Leslie for his highly valuable and beautiful painting, and to Mr. Morgan for his interest in having the same forwarded.

The collection of recent donations to the Museum, which were arranged on the table, afforded subjects for remarks from several members.

Mr. F. W. Putnam spoke of the skulls of the polar bear, seal, and that of an Esquimaux, from Hopedale in Greenland, presented by Copley Amory, Esq., of Boston.

Mr. E. S. Morse gave a brief outline of the growth of shells, particularly that of the cowrie, which he illustrated by drawings on the blackboard.

Prof. A. E. Verrill, of Yale College, described the external structure of the star-fishes found on our coast, and gave a very interesting account of their habits, alluding to the great injury sometimes done to our oyster-beds by the ravages of these voracious animals. He mentioned there were three distinct species, and pointed out the characteristic differences.

Donations to the Library and Museum were announced.

Messrs H. Wheatland, W. P. Upham, and H. M. Brooks were appointed a committee to nominate officers for election at the Annual Meeting.

Edward B. Perkins, W. S. Cook, J. A. Paine, jr., of Salem; John V. Stevens, of South Danvers; and Albion Smith Dudley, of Danvers, were elected Resident Members.

WEDNESDAY, MAY 8, 1867. Annual Meeting.

Vice President GOODELL in the chair.

Records of the last annual and regular meetings were read.

The annual reports of several of the officers were read and accepted.

The SECRETARY, in his report, stated that more important results have occurred within the past year for the promotion of science in this county than in any preceding.

The formation of a fund for the above purpose by Mr. George Peabody, the details of which have been published, will, without doubt, be productive of good results; and if the plans, that are now merely inceptive, be carried out in a proper spirit a noble institution

will be established. A committee of seven members were appointed at the meeting on the 4th of March last to receive plans and suggestions from the Trustees of the Peabody fund, and to report at some future meeting, to be called for the purpose, what action it will be expedient for the Institute to adopt in relation thereto.

Seventy-seven Resident and sixteen Corresponding Members have been elected during the year. Notice of the death of five of the former and four of the latter have been received. The present number of members is 764, consisting of 581 Resident, and 183 Corresponding.

Biographical notices of the following deceased associates will be prepared for the *Historical Collections*. JESSE SMITH died at Salem, July 4, 1866, aged 76 years and 6 months; THOMAS AUGUSTUS SWEETSER died at South Danvers, Oct. 24, 1866, aged 45 years and 9 months; SAMUEL M. WORCESTER died at Salem, Aug. 16, 1866, aged 65 years; ROBERT BROOKHOUSE died at Salem, June 10, 1866, aged 86 years and 6 months; NATHANIEL HOOPER died at Salem, January 13, 1867, aged 71 years; REUBEN D. MUSSEY died at Boston, June 21, 1866, at the age of 86 years; AUGUSTUS A. GOULD died at Boston, Sept. 15, 1866, aged 61 years; SAMUEL SWETT died at Boston, Oct. 28, 1866, at the age of 84 years; FRANCIS N. CLARK died at Key West, Florida, August, 1866, aged 45 years and 6 months.

MEETINGS. — Five Field Meetings have been held, during the past season, at Haverhill, Asbury Grove in Hamilton, Manchester, Salisbury Beach, and Gloucester. They were very successful and largely attended, and at every place received the kind attentions of the citizens, who extended a cordial welcome. Our thanks are due to the friends in the several places visited; also to the Directors, Superintendents, and officers of the Eastern, and Boston and Maine Railroads for courtesies extended on all occasions. The quarterly and semi-monthly meetings have been held as usual. The Social Gathering at Hamilton Hall, on Monday evening, Dec. 3, 1866, passed off very pleasantly, and received the approval of the large company in attendance. The subject of discussion was "The Teeth and Mouth-parts of Animals." Professor WYMAN, of Cambridge; Messrs. S. H. SCUDDER, of Boston, E. S. MORSE and A. HYATT, of the Institute; and Rev. E. C. BOLLES, of Portland, made interesting and appropriate remarks, which were illustrated by preparations placed under thirty-four microscopes arranged around the hall. The examination of these illustrations at the close of the speaking formed a very pleasant feature of the meeting.

LECTURES. — A course of five lectures by E. S. MORSE, on Zoölogy, was delivered in March and April in Lyceum Hall, under the auspices of the Institute; they were well received, and gave great satisfaction to an appreciative audience.

The CORRESPONDENCE has largely increased in consequence of the more extended circulation of the different publications, a thousand or more letters have been received by those having in charge the different departments, and placed on file.

The PUBLICATIONS. — The HISTORICAL COLLECTIONS and the PROCEEDINGS have been continued as in previous years. Unavoidable circumstances have somewhat delayed their appearance. It is presumed that, under the new arrangements of printing, they will be issued with more punctuality, and be deserving of a good degree of patronage. The AMERICAN NATURALIST, a popular Magazine of Natural History recently commenced under the editorship of Messrs. PACKARD, HYATT, MORSE, and PUTNAM, is a decided success, and is receiving a good share of encouragement. It is published monthly, at \$3.00 per annum.

The establishment of Mr. E. BICKNELL in Salem, for the preparation of Microscopic Slides, is doing much to encourage a taste for microscopic study. Mr. Bicknell is very successful in his preparations. This establishment will prove instrumental in the promotion of several of the objects for which the Institute was organized.

The establishment of a private Printing Office for the purpose of printing the several publications of the Institute will enable the Institute to issue its publications more promptly and in a more finished manner than heretofore.

The HORTICULTURAL EXHIBITIONS were omitted the past season in consequence of the scarcity of fruit, and the presumed uncertainty of having a display that would be creditable to the cultivators in this county.

The TREASURER presented the following statement of the financial condition for the year ending May, 1867.

GENERAL ACCOUNT.

Debits.

Athenæum; Rent, half Fuel, and Librarian,	\$693.20
Publications, \$1,195.80; Salaries, \$296.20; Gas, \$14.00,	1,506.00
Express, etc., \$39.58; Sundries, \$151.57,	191.15
To Historical account,	92.00
To Natural History and Horticultural account,	9.06
Balance in Treasury,	29.92
	<hr/>
	\$2,521.33

Credits.

Balance of last year's account,	\$62.48
Dividends Webster Bank, \$40; Coupons U. S. Bonds, \$36.50,	76.50
United States Bond, \$500 7-30s,	525.00
Books, etc., \$147.03; Athenæum for Janitor, \$104.00,	251.03
Sale of Publications, \$636.32; Assessments, \$970.00	1,606.32
	<hr/>
	\$2,521.33

NATURAL HISTORY AND HORTICULTURE.

Debits.

Preservatives and Specimens, etc.,	\$136.83
Lectures, \$144.00; Social Meeting, \$218.48,	362.48
	<hr/> \$499.31

Credits.

Lectures, \$155.50; Social Meeting, Dec. 3, \$239.75,	\$395.25
Dividends Lowell Bleachery, \$60.00; P. S. P. R. R., \$12.00,	72.00
Sundries,	23.00
General account,	9.06
	<hr/> \$499.31

HISTORICAL ACCOUNT.

Debits.

Binding,	\$150.00
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Credits.

Dividend Naumkeag Bank,	\$20.00
Coupons Michigan Central R. R. Bond,	38.00
General account,	92.00
	<hr/> \$150.00

The LIBRARIAN reported that the additions to the Library have been as follows :—

Folios 7; Quartos 33,	40
Octavos 725; Duodecimos, etc., 657,	1,382
Pamphlets and Serials,	2,622
Volumes of Newspapers, Folios,	42
	<hr/> 4,086

The above have been obtained, with few exceptions, by exchange with editors and kindred institutions, and by donations from members and friends of the Institution.

The largest donation was from Mrs. FIDELIA W. ARCHER, consisting of 663 pamphlets, 266 serials, and 446 bound volumes, being a part of the library of our late esteemed associate, Rev. S. M. Worcester, D. D., of Salem, a valuable addition, and enabling us to complete several of the serial publications in the Library.

Dr. BENJAMIN PICKMAN, of Boston, and AUGUSTUS PERRY, of Salem, have made valuable contributions.

The contributors may be classed as follows :—

General Government and its Departments, State and Municipal Governments, and Societies,	50
Editors,	12
Individuals,	147
	<hr/> 209

The total number of different receipts from the above contributors amounted to eight hundred and seventy.

If the plans in contemplation with the Trustees of the "Peabody Fund" should be completed, more extensive accommodations will be devoted to the Library, which is now required for the proper arrangement of the books.

The SUPERINTENDENT OF THE MUSEUM stated that over 13,000 specimens had been added to the Natural History Department in 288 donations during the year. Sixty-six donations, embracing a large number of specimens, have been made to the Historical Department. For special mention of these various donations reference is made to the quarterly printed lists; but the Superintendent would call special attention to the valuable aid received from the following gentlemen. Prof. D. S. SHELDON, of Davenport, Iowa, has not only sent to the Institute his whole collection of Plants and Western Shells, but has taken special pains to collect for us the fresh-water Fishes, Crustaceans, Insects, and Shells of the vicinity of Burlington, Iowa. Mr. ALFRED S. PEABODY, of Salem, has presented a collection of the skins of about forty specimens of South African Birds, in good condition, also a number of Reptiles, Fishes, and other specimens in alcohol, from the vicinity of Cape Town. To Mr. ROBERT E. C. STEARNS, of San Francisco, we are placed under great obligations for his continued interest in our Museum, evinced by his generosity in sending several collections of Pacific Coast Shells, and specimens of Ores, Minerals, Fossils, etc. We have also continued to receive specimens, principally of Radiates and Crustaceans, from Panama and Long Island Sound, from the MUSEUM OF YALE COLLEGE. Mr. JOHN H. SEARS, of Danvers, has commenced making a collection of the nests and eggs of our local Birds, much needed for the completion of the Ornithological collection of our county.

Owing to the increase of the collection, and the great amount of business attending the various operations of the Institute, not as many duplicate specimens have been distributed during the past year as the one preceding, though a number of boxes are gradually being filled for our friends, and will be forwarded as soon as possible. The following collections have been sent out during the year.

To Prof. A. E. VERRILL, Yale College, 67 species, 198 specimens of Corals, from the Straits of Malacca, Hayti, Sandwich Islands, and Zanzibar. Eleven species, twelve specimens of Echinoderms from various localities.

To Rev. A. B. KENDIG, Davenport, Iowa, seventy-nine species, of several specimens each, of North American Shells, principally land and fresh-water species.

The working corps of the Natural History Department has been most satisfactorily increased by the addition of Messrs. Morse, Packard, and Hyatt as officers of the Institute, and we thus have been enabled, by a division of labor, to greatly enlarge our sphere of operations and usefulness.

The munificent donation by Mr. Peabody for the advancement of science in our county will undoubtedly be the means of placing the scientific department on a permanent footing, and will prove an additional laurel to one whose name almost seems to be the talisman that creates Museums, Libraries, Schools, and other aids for the promotion of education and morality, and encourages them in their noble work.

The following Officers were elected for the year ending May, 1868 :

President.

FRANCIS PEABODY.

Vice Presidents.

Natural History—SAMUEL P. FOWLER. *History*—A. C. GOODELL, jr.

Horticulture—ANDREW LACKEY.

Secretary and Treasurer.

HENRY WHEATLAND.

Librarian.

CHARLES DAVIS.

Superintendent of the Museum.

F. W. PUTNAM.

Finance Committee.

J. C. Lee, R. S. Rogers, H. M. Brooks, G. D. Phippen, J. Chamberlain.

Library Committee.

J. G. Waters, A. Crosby, H. J. Cross, G. D. Wildes, William Sutton.

Publication Committee.

A. C. Goodell, jr., G. D. Phippen, C. M. Tracy, Wm. P. Upham, R. S. Rantoul, F. W. Putnam, A. S. Packard.

Lecture Committee.

Francis Peabody, A. C. Goodell, jr., G. D. Phippen, George Perkins, James Kimball, F. W. Putnam, A. Hyatt.

Field Meeting Committee.

Francis Peabody, G. B. Loring, C. M. Tracy, S. P. Fowler, J. M. Ives, G. D. Wildes, E. N. Walton, Charles Davis, E. S. Morse.

Curators of Natural History Department.

Geology—Alpheus Hyatt. *Mineralogy*—D. M. Balch. *Palæontology*—H. F. King, Alpheus Hyatt. *Botany*—C. M. Tracy. *Comparative Anatomy*—Henry Wheatland. *Vertebrata*—F. W. Putnam. *Articulata*—J. H. Emerton, A. S. Packard. *Mollusca*—H. F. King, E. S. Morse. *Radiata*—Caleb Cooke, E. S. Morse. *Protozoa*—Alpheus Hyatt. *Microscopy*—H. F. King, H. F. Shepard, B. Webb, jr., Edwin Bicknel.

Curators of Historical Department.

Archæology—G. P. Russell. *Ethnology*—William S. Messervy, M. A. Stickney, John Robinson. *Manuscripts*—W. P. Upham, H. M. Brooks. *Fine Arts*—Francis Peabody, J. G. Waters, J. A. Gillis.

Curators of Horticultural Department.

Fruits and Vegetables—J. M. Ives, J. S. Cabot, R. S. Rogers, John Bertram, G. B. Loring, S. A. Merrill, W. Maloon, G. F. Brown, C. H. Norris, C. H. Higbee, W. D. Northend, J. F. Allen. *Flowers*—Francis Putnam, William Mack, Benj. A. West, Geo. D. Glover.

Mr. F. W. Putnam introduced the following resolves, which were seconded by Mr. A. Hyatt, and adopted unanimously :—

Whereas, Professor L. AGASSIZ, during the last session of Congress, by his successful and untiring efforts, procured the passage of a law which enables scientific societies to obtain alcohol, used for the preservation of specimens of Natural History, free from the excise tax.

Be it Resolved, That the thanks of the Essex Institute are due to Professor AGASSIZ for this great benefit thus rendered in aid of scientific research.

Resolved, That the Secretary be requested to transmit a copy of these Resolutions to Professor AGASSIZ.

The following votes were then passed :—

Voted, That the Committee appointed at the meeting of the 4th of March last, to receive proposals and confer with the Trustees of the Peabody Fund, consider the expediency of depositing the Scientific Collections of the Institute in the East India Marine Hall, on such terms as they may legally make with the Trustees, and to report at the next meeting.

Voted, That the Curators of Horticulture be authorized to hold exhibitions of fruits, flowers, and vegetables, at such times and places as may be desirable, and to adopt such regulations as may be requisite for the proper conducting of the same.

Daniel Henderson, Edwin R. Bigelow, C. A. Benjamin, and James L. Ward, of Salem, were elected Resident Members.

FRIDAY, MAY 24, 1867. Special Meeting.

Vice President GOODELL in the chair.

The following call of the meeting was read:—

SALEM, May 21, 1867.

"A Special Meeting of the Essex Institute will be held at their rooms, in Plummer Hall, Salem, on Friday afternoon next, at 3 o'clock, to act upon the report of the Committee on the removal of the Scientific Collections of the Institute to the East India Marine Hall."

[Signed]

H. WHEATLAND, *Secretary*.

The Committee of Conference with the Trustees of the Peabody Fund, offered the following Report:—

ESSEX INSTITUTE, May 24, 1867.

Your Committee of seven members of the Institute, appointed to confer with and receive proposals from the Trustees of the Peabody Fund, ask permission to offer as their report the following communication received from the Trustees, and resolutions of this Committee:

SALEM, May 21, 1867.

F. W. PUTNAM, Esq., *Chairman Com. of the Essex Institute*,

DEAR SIR,—"After the full and satisfactory conference with your Committee on Friday evening, in relation to the deposit of the Natural History collection of the Institute with the Trustees, the undersigned, in behalf of the Trustees, submit the following proposal:—

The Trustees will take the collections and specimens in Natural History of the Institute upon special and permanent deposit, place them in East India Marine Hall, and keep them there or in a building equally as good in Salem, arrange and label them as the deposit of the Institute, and give to them the same care and attention which they give to other collections and specimens deposited in the same place of a similar character. The usual arrangement in regard to exchanges of duplicates being observed, and due credit therefor being given to the Institute. To the collections, when properly arranged in the said Hall, the members of the Institute are to have access, and the same privileges to study and examine the same which they now have under the rules and regulations of the Institute. All the expenses of removal, arrangement, and care to be borne by the Trustees.

The Trustees will also pay to the Institute the sum of one thousand dollars for the ten table and upright cases, now standing in the Museum of the Institute, and the shelving in the permanent cases of the Museum, upon which a portion of the collection is now arranged.

Articles of agreement upon the above basis should be drawn and executed by the parties.

In behalf of the Trustees the undersigned would repeat, what they have before stated, that it will give the Trustees great pleasure thus to coöperate with the Institute in a common object. It promises most favorably for their future harmony of action, and seems to insure the establishment of an institution, which, drawing its life and strength from the well-earned position of the Institute, the zeal and activity of its members, and the large and munificent gift of Mr. Peabody, will be an honor to the county and a source of great benefit to its people.

It is hardly necessary to state in detail the action which the Trustees intend to take. The arrangement of the Museum requiring at once a large outlay, the erection, as soon as practicable, of a lecture hall and laboratories for the chemical and natural history departments, and such other buildings as may be necessary. All this has been stated in our conference with you.

And the undersigned will say in conclusion that the Trustees are especially desirous of coöperating with the members of the Institute in carrying out the great objects of their trust, in promoting some of which in the past the Institute has attained so much distinction, and hope that you will agree to the above proposal.

Very truly yours,"

[Signed]

WM. C. ENDICOTT,
O. C. MARSH,
H. WHEATLAND.

Resolved, That the communication received from a Committee of the Trustees of the Peabody Fund, duly authorized to represent that body in the adjustment of terms for the transfer of the Scientific Collections of the Essex Institute to the East India Marine Hall, covers a proposal wholly acceptable to this Committee in its substance and details.

Therefore Resolved, — That we will forthwith present the same to a special meeting of the Essex Institute, to be called for the purpose, on Friday, the 24th instant, with our unanimous approval and indorsement.

All of which is respectfully submitted by your Committee,

F. W. PUTNAM, <i>Chairman</i> ,	} Committee.
GEO. B. LORING,	
WM. P. UPHAM,	
R. S. RANTOUL,	
CHARLES MANSFIELD,	
H. M. BROOKS,	
ALPHEUS HYATT.	

The report of the Committee was accepted, and the following votes were passed unanimously: —

Voted, That the Scientific Collections of the Institute be deposited with the Trustees of the Peabody Fund, as proposed in the Report of the Committee, and that a Committee of three be appointed to carry out the plan, with full power to sign all papers necessary therefor in behalf of the Institute.

Voted, That the same Committee be authorized to carry out all the other details of the plan proposed by the Trustees, and have power to sell the upright and table cases now in the centre of the large hall of the Museum, and the painted shelving in the other cases in the same room; also, to make the same agreement extend to all future additions that may be hereafter made to the Natural History Collection.

SAMUEL P. FOWLER, HENRY F. KING, and ROBERT S. RANTOUL were appointed as the Committee.

The following is a copy of the agreement made by the Institute, through its Committee of three, with the Trustees of the Peabody Fund:—

“This agreement, made this twenty-ninth day of May, A. D. eighteen hundred and sixty-seven, by and between the Essex Institute, a corporation duly established by law at Salem in the county of Essex and Commonwealth of Massachusetts, party of the first part, and Francis Peabody, Asa Gray, William C. Endicott, Othniel C. Marsh, George Peabody Russell, Henry Wheatland, Abner C. Goodell, jr., James R. Nichols, and Henry C. Perkins, trustees as hereinafter named, parties of the second part, witnesseth, —

That whereas the said parties of the second part have been appointed trustees under a certain instrument of trust, given by George Peabody, Esq., on the 26th day of February, A. D. eighteen hundred and sixty-seven, for the objects and purposes therein named, and for said purposes are empowered to make arrangements and agreements with the said Essex Institute.

Now, therefore, it is agreed by and between the parties hereto, in consideration of the foregoing and of the mutual agreements and undertakings herein recited, that the scientific collections of the said Essex Institute shall be deposited with said trustees, upon a special, permanent deposit and trust, to be kept by them and their successors forever in the East India Marine Hall, so called, in said city of Salem, or in some other building equally as good, and located in said city; said scientific collections to be properly cared for and arranged according to such methods as shall, in the judgment of said trustees, make them most available for the benefit and instruction of the public, and to receive the same attention which the said trustees may give to other collections and specimens of a similar character which they may at any time hold or acquire; to be labelled with the name and as the collections of the Essex Institute, and catalogued as such; that all specimens similar to those forming the collections now deposited by the Institute, which may hereafter be received by the Institute, shall be deposited with said trustees, and shall be by them received and treated in all respects like specimens in the original deposit; that duplicates now embraced, or hereafter to be embraced in said collections, and any specimens which may become duplicate, by the placing of said collections in the same building with other collections of like nature, may be exchanged by said trustees according to the usual custom of exchanges of duplicates; and all articles and specimens received in exchange therefor shall be labelled and catalogued as aforesaid, and shall be held and kept by the said trustees and their successors forever, together with the original deposit of which they shall become a

part, for the promotion of science and useful knowledge among the inhabitants of the County of Essex.

And it is further agreed, that upon the rearrangement of the said collections by the said trustees as aforesaid, the officers and members of the Essex Institute shall have free access to, and the same rights and facilities to use, study and improve their said collections, under such proper regulations as may be imposed by said trustees, which they now enjoy under the rules and regulations of the Institute; and it is farther agreed that if any difference of opinion shall arise between the parties hereto as to the manner of carrying out this agreement, and the parties hereto are unable to agree, such difference shall be referred to the decision of three disinterested persons whose decision in the premises shall be final. And to the carrying out of each and all of the agreements and undertakings herein set forth, the parties of the first and second part bind themselves and their successors firmly by these presents.

In witness whereof the said Essex Institute, party of the first part, hath caused these presents to be executed in its name and its corporate seal to be affixed to the same by Samuel P. Fowler, Henry F. King, and Robert S. Rantoul, thereto being duly authorized by a vote of said corporation, a copy whereof is hereto annexed.*

And the said trustees, parties of the second part, have severally affixed their hands and seals."

The Essex Institute by
 SAM'L P. FOWLER,
 HENRY F. KING,
 ROBERT S. RANTOUL, } [Seal of the Essex Institute.]

[Signed]

FRANCIS PEABODY,	[L. s.]
ASA GRAY,	[L. s.]
WM. C. ENDICOTT,	[L. s.]
O. C. MARSH,	[L. s.]
GEO. PEABODY RUSSELL,	[L. s.]
HENRY WHEATLAND,	[L. s.]
ABNER C. GOODELL, JR.,	[L. s.]
JAS. R. NICHOLS,	[L. s.]
H. C. PERKINS,	[L. s.]

MONDAY, JUNE 17, 1867. Regular Meeting.

Judge WATERS in the chair.

Henri F. Woods, of Rockport; Jesse Robbins, N. A. Very, Alfred S. Peabody, and Temple Hardy, of Salem, were elected Resident Members.

* See vote on page 142.

*Additions to the Museum and Library during April,
May, and June, 1867.*

TO THE NATURAL HISTORY DEPARTMENT.

BY DONATION.

AMORY, COPLEY, Boston. Skulls of an Esquiman, of a Polar Bear, and of a Seal, from Hopedale, Labrador; also a *kayak* from the same place.

BROOKHOUSE, ROBERT, Salem. A Canvas-back Duck, *Aythya valisneria*, male; and a Bald Pate, *Mareca Americana*, male, from the Chesapeake.

BROWN, CHARLES, Beverly. Specimen of Copper Ore.

CLOUTMAN JOSEPH P., Salem. Specimens of Copper Ore from the Pewabic Mine.

DOW, JAMES, Beverly Farms. Specimen of *Coluber eximius* from Beverly.

EMERTON, J. H., Salem. Larva of a *Carabid* from Haverhill.

Goss, F. P., Salem. Red Granite from the quarries at Gloucester, Mass.

GRIFFIN, H. B., Salem. A specimen of the Sheldrake, *Mergus Americanus*, from Salem.

HAWN, Major F., Leavenworth, Kansas. Specimens of *Caloptenus femur-rubrum*, in various stages of growth, from Leavenworth City.

HOLDER, Dr. J. B., U. S. A., Fort Jefferson, Fla. Seventy-seven specimens of Corals and four of Sponges from Key West, Florida.

HUNTINGTON, ARTHUR, Salem. Specimen of the Flying Lizard, *Draco volans*, from the Philippine Islands.

JONES, GEORGE W., Salem. Two specimens of *Scolopendra*. Specimen of *Cymothoa*, taken from the eye of a Fish at the Island of Bonair. Three young Rabbits from Salem.

KIMBALL, JAMES, Salem. Parasitic worms from the common Clam, *Mya arenaria*, from Ipswich.

MOODY, HENRY D., Cambridge. A collection of Insects from Cambridge, Mass.

MORSE, E. S., Salem. Pieces of Rock, showing glacial scratches, from Portland, Me.

MUSEUM OF YALE COLLEGE, New Haven, Ct. Collection of Radiates from Panama and other localities; also, a collection of Minerals from various localities.

NELSON, S. A., Georgetown, Mass. Specimen of *Dicercia divaricata* from Georgetown.

OSBORNE, J., Salem. Collection of various objects of Natural History.

OSGOOD, J. C. Salem. Shells from the keel of the "Said Ben Sultan," from Zanzibar.

PACKARD, Dr. A. S., jr., Salem. Specimens of *Mycetobia*, in all its stages, and collection of various injurious larvæ, from Salem.

PEABODY, ALFRED S., Cape Town, Africa. A fine collection of seventy-two specimens, thirty-eight species, of Birds' Skins from the eastward of the Cape of Good Hope; also, a Bird's Nest and two species of Snakes from the vicinity of the Cape of Good Hope. Specimen of *Grapsus* from the Cape of Good Hope, and a specimen of *Madrepore*, from the Island of Mauritius.

PECK, WILLIAM, Salem. Specimens of Lichens from Florida.

PERKINS, Capt. J. W., Salem. A collection of Shells from the Pacific Ocean.

PUTNAM, F. W., Salem. Glacial Pebbles from the top of Black Mountain, Bethel, Maine. Embryos of Night Hawk; Nest and Eggs of the Red-eyed Vireo, and a collection of Insects, from Bethel, Me.

RANTOUL, R. S., Salem. An African Mouse found in a box at the Custom-house.

REEVES, R. W., Salem. Jaws of a Shark, *Lamna punctata*, from Massachusetts Bay.

ROBINSON, JOHN, Salem. Specimens of *Anatifa* from the bottom of a vessel.

SHATSWELL, JOSEPH, Salem. Two mounted specimens of Boa from Brazil.

SHEPARD, Henry F., Salem. A collection of Shells.

STEARNS, CHARLES A., Boston. Ruby Silver from Austin, Nevada. Cinnebar from the New Almaden Mine, California.

TENNEY, Prof. Sanborn, Poughkeepsie, N. Y. Four specimens of *Glyptemys insculpta*, one of *Chrysemys picta*, six of *Cistudo Virginica*, from Poughkeepsie, N. Y.

TRUE, Dr. N. T., Bethel, Me. Fossil Coral from Leroy, N. Y.

UPTON, Capt. GEORGE, Salem. Specimen of Lump Fish, *Cyclopterus lumpus*, taken in Salem Harbor.

WARD, JAMES L., Salem. A malformed Claw of a Lobster, *Homarus Americanus*.

WHEATLAND, Miss M. G., Salem. Sixteen skulls of Birds, one of the Green Turtle, and several shells, from St. Augustine, Florida.

TO THE HISTORICAL DEPARTMENT.

BY DONATION.

PULSIFER, DAVID, Boston. A Picture of the "Hancock House," and two specimens of Chinese Printing.

STICKNEY, M. A., Salem. A Gun-lock from the Battle-field of Newbern.

STONE, B. W., Salem. A piece of Sheet Rubber made by Mr. Day, of Connecticut, and a piece of Insulated Elastic Electric Cable.

TO THE LIBRARY.

BY DONATION.

BARTLETT, JOHN R., Secretary of State, Providence, R. I. Report upon the Census of Rhode Island, 1865, 8vo pamphlet, Providence, 1867.

BOLLES, E. C., Portland, Me. New England Hist. Gen. Register, vols. 1, 2, and 3.

BOSTON, CITY OF. Boston City Documents, 1866, 2 vols. 8vo; vol. 1, 1861, 8vo, 1 vol. Boston Municipal Register, 1 vol. 8vo, Boston, 1867.

BRAMAN, Mrs. SARAH B., Georgetown, Mass. Engraving of Rev. Isaac Braman, late of Georgetown; taken Jan. 1, 1852. He was born July 5, 1770.

BROOKS, H. H. 13 Pamphlets.

BRYANT, JAMES S., Hartford, Conn. Geer's Hartford Directory, 1859 to 1865 inclusive, 7 vols. 16mo. Connecticut Register for 1860 to 1866 inclusive, 7 vols. 16mo, Hartford. Adjutant-general's Report, Conn., 1864 and 1865, 2 vols. 8vo. Navy Register of United States, 1865, '66, '67, 3 vols. 8vo. 30 Miscellaneous Pamphlets.

BUTLER, BENJAMIN F., M. C., United States House of Representatives. Speeches of Butler and Bingham, March, 1867, 8vo pamphlet. Speech of William D. Kelly, M. C. in U. S. Congress, Jan. 3, 1867. Message and Documents, 1866-67, abridgment, 1 vol. 8vo, Washington, 1867. Message and Documents, 1865-66, pts. 3 and 4 of Department of State, 2 vols. 8vo, Washington, 1866. Message and Documents, Interior Department, 1866-67, 1 vol. 8vo, Washington, 1867. Report of Commissioner of Agriculture for 1865, 1 vol. 8vo, Washington, 1866. Report of Committee on New Orleans Riots, 1 vol. 8vo, Washington, 1867. Report of Committee on Internal Revenue Frauds, 1 vol. 8vo, Washington, 1867. Report of Committee upon New York Customhouse, 1 vol. 8vo, Washington, 1867. Reports upon the Mineral Resources of the United States, 1 vol. 8vo, Washington, 1867.

CHASE, GEORGE C. Friend's Review, 11 numbers.

COGSWELL, WILLIAM. Quint's Record of Second Mass. Infantry, 1861-65, 1 vol. 8vo, Boston, 1867.

COPE, E. D., Philadelphia. Monographs on the Anura, Urodela, and Cyprinidæ, by Prof. E. D. Cope. 3 4to pamphlets, Philadelphia, 1867.

CROSBY, ALPHEUS. *The Words of Chants and Anthems sung at Church Green, Boston*, 1 vol. 12mo, Boston, 1858.

DALAND, WILLIAM S., New York. *Trow's New York Directory*, 1866, 1 vol. 8vo.

DODGE, ALLEN W., Hamilton. 4 Miscellaneous Pamphlets.

FARNUM JOSEPH. *Ferguson's Astronomy*, 2 vols. 8vo, 4to vol. of plates, Philadelphia, 1817. *Barton's Medical Botany*, 2 vols. in one, 4to, Philadelphia, 1817. *American Baptist Magazine*, from 1835 to 1856, 31 vols. 8vo. *Cœuvres de Montesquieu*, 3 vols. 4to, London, 1767.

GREEN, SAMUEL A., Boston. *Thirtieth Annual Report of Board of Education of Massachusetts*, 1 vol. 8vo, Boston, 1867. *Fourteenth Annual Report of Board of Agriculture of Massachusetts*, 1 vol. 8vo, Boston, 1867. 77 Miscellaneous Pamphlets. *Twenty-ninth Annual Report of Board of Education of Mass.*, 1 vol. 8vo, Boston, 1866. *Fitchburg in the War of the Rebellion*, by Henry A. Willis, 1 vol. 8vo, Fitchburg, 1866.

HAMMOND, JOSEPH, *The Friend*, 9 vols. 4to, Honolulu, S. I., 1844 to 1866.

HEICH, JOHN B., Secretary Ohio Mechanic's Institute. *Thirty-ninth Annual Report of Ohio Mechanics Institute*, 8vo pamph., Cincinnati, 1867.

HIGBEE, CHARLES, *Zacho's Primer and Reader*, 12mo, pamph., Boston, 1864. *First Annual Report of Educational Commission for Freedmen*, 8vo pamph., Boston, 1863.

HOOD, ASA. Several Manuscripts, Deeds, etc.

HORTON, N. A. Files of the County Papers for several months.

HUNT, THOMAS F. *A Vocabulary, with Colloquial Phrases of the Canton Dialect*, by S. W. Bonney, 1 vol. 8vo, Canton, 1854.

LESQUEREUX, L. *Lesquereux on the Fossil Plants from the Tertiary of Mississippi*, 4to pamph.

LORD, N. J. Files of Boston Post for January, February, March, 1867.

LORING, GEORGE B. Files of the Boston Post, January, February, March, April, 1867.

LUNT, W. P., Boston, *Addresses or Discourses by the late W. P. Lunt, of Quincy*, 11 pamphlets, 8vo.

MACK, DAVID, jr., Belmont. *Puget Sound Daily for June 22*, 1866.

MARSH, O. C., New Haven, Ct. *Catalogue of Official Reports upon Geological Surveys of the United States and British Provinces*, 8vo pamphlet, New Haven, 1867.

MORSE, GEORGE F., Portland, Me. 23 Pamphlets.

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MONDAY, JULY 2, 1867. Field Meeting at Haverhill.

The first Field Meeting of the season was held this day, which was perfect for a rural excursion. After the morning rendezvous at the spacious and beautiful Town Hall of Haverhill, where the Institute was welcomed by Dr. J. R. Nichols, for the citizens of the town, the company divided. A part visited one or more of the great shoe establishments for which Haverhill is famed. Another party went directly to the beautiful picnic grove on the banks of Lake Kenosha. Near this fine sheet of water was the birthplace of Whittier; and its favorite name, for on the map it appears as "Great Pond," is one bestowed upon it in a poem familiar to his readers:—

* * * * *

"Lake of the pickerel!—let no more
The echoes answer back 'Great Pond,'
But sweet Kenosha, from thy shore
And watching hills beyond,"

* * * * *

"The shores we trod as barefoot boys,
The nutted woods we wandered through,
To friendship, love, and social joys
We consecrate anew."

* * * * *

"Kenoza! o'er no sweeter lake
Shall morning break or noon-cloud sail,—
No fairer face than thine shall take
The sunset's golden veil."

The rest of the company went as other attractions drew them.

At 1 o'clock the company assembled at the Town Hall and partook of their collation, where they found, in addition to the supplies they carried with them, an abundance of hot tea and coffee, which added much to the enjoyment of the feast.

The party then repaired to the chapel of the North Congregational Church, where the meeting was called to order by Dr. Geo. B. Loring, of the Committee on Field Meetings, who appropriately congratulated the assembly on the extraordinary bounteousness of the season, and the peculiar privileges enjoyed by the people of the county in the Essex Institute.

He then introduced Vice-president S. P. FOWLER as chairman of the meeting.

Mr. Fowler, on taking the chair, remarked upon the interesting history of Haverhill as an old frontier town in the days of Indian warfare; and recommended that its inhabitants should carefully save from destruction all the old documents they might have in their houses, and send them to the Institute for permanent preservation among its collections.

Letters were announced from, — Prof. L. Agassiz, Cambridge (May 13); A. B. Ashby, Newburyport (June 21); Capt. N. E. Atwood, Provincetown (June 19); Copley Avery, Boston (May 23); Prof. S. F. Baird, Smithsonian Institution (May 19, June 9, 19); W. J. Beal, Union Springs, N. Y. (May 24); C. A. Benjamin, Salem (May 14); Rev. E. C. Bolles, Portland, Me. (June 8); Dr. Daniel Clarke, Flint, Mich. (May 17); Gen. W. Cogswell, Salem (June 7); J. Colburn, Boston (June 4, 22); Congressional Library (June 5); W. S. Cook, Salem (May 18); Henry Davis, Decorah, Iowa (June 20); W. W. Denslow, New York (June 18, 23); T. A. Dickinson, Lewiston, Me. (June 23); Dr. A. S. Dudley, Salem (June 14); C. H. Hart, Philadelphia, Pa. (May 9); J. P. Haskell, Marblehead (June 25); O. P. Hubbard, New Haven, Ct. (June 11); W. H. Kerns, Boston (June 23); J. P. Langworthy, Boston (June 29); Rev. Samuel Lockwood, Keyport, N. J. (July 25); Horace Mann, Cambridge (May 18); Wm. Merritt, Boston (June 25); J. S. Moyer, Plumsteadville, Pa. (May 16); C. H. Nauman, Lancaster, Pa. (June 6); S. A. Nelson, Georgetown (June 7); New Bedford Public Library (May 6, 20, 25); New England Historic-Genalogical Society, Boston (April 22); New York Lyceum of Natural

History (May 13); New York Mercantile Lib. Assoc. (June 20); Dr. J. R. Nichols, Haverhill (June 6, 24, 28); Gen. Albert Ordway, Richmond, Va. (June 6); S. P. Finci, Salem (June 20); Saint Louis Academy of Science (May 25); Smithsonian Institution (June 5, 7); F. Snyder, Le Claire, Iowa (May 28); Frank Stratton, Natick (June 15); Prof. S. Tenney, Vassar Female College, N. Y. (June 2); Prof. A. E. Verrill, Yale College (May 26, June 9, 18); Judge J. G. Waters, Salem (May 8); J. K. Wiggin, Boston (June 12); Dr. B. G. Wilder, Cambridge (June 25); Prof. H. C. Wood, Philadelphia, Pa. (June 21).

Donations to the Museum and Library were announced.

Mr. C. W. Felt, of Salem, presented a copy of his book on the "combined letter system," explaining briefly the objects of the same.

Dr. James R. Nichols, of Haverhill, after some complimentary allusions to the visit of the Institute to Haverhill, spoke of the donation of Mr. Peabody and the coöperation of the trustees of that gift with the Essex Institute, for the advancement of science and useful knowledge in this county. He then referred with high commendation to the enthusiastic and successful efforts to this end of the several young men who are connected with the Institute.

Mr. F. W. Putnam, of Salem, in response to a call, spoke of the plant lice found on the leaves of the currant and the rose, and also of the habits and development of the red-backed salamander, specimens of which he exhibited to the meeting.

Dr. Nichols mentioned in this connection that a chemical combination, carbolic acid, was antagonistic to animal life, and a dilution of one half of one per cent. of this acid in water would destroy the red spider and other insects on plants. Carbolate of lime, sprinkled about on squash vines, would free them from insects.

Mr. Edward S. Morse, of Salem, drew a very fine comparison of the studies of the naturalist residing near the sea with those of one in the interior, and alluded to the families of animals found in those respective localities, all of which were worthy of study. He then illustrated the anatomy of the unio, or fresh-water clam, and compared it with the common clam of our shores.

Rev. Dr. Seeley, of Haverhill, gave some account of the "coquina," or shell formation of Florida, which had come under his observation, and then spoke of the probable effects of the work of the Institute in developing the latent genius of the people, and awakening a zeal for further researches into the strange realities of nature.

Mr. Alpheus Hyatt, of Salem, asked the question, Where do the rocks come from, which compose our stone-walls? The answer to this question takes us to the glacier formations as observed in the Alps. He then remarked that a similar process had been undergone in the valley of the Merrimac, as noticed by him during a visit to the

banks of the river near West Newbury the past week. He then spoke of the "American Naturalist," a popular illustrated magazine of natural history, published under the auspices of the Essex Institute, and appealed to the people of the county to give it a cordial support and patronage.

Hon. Allen W. Dodge, of Hamilton, spoke of the importance of the Institute and its publications in advancing the great cause of education, showing the practical value of a knowledge of nature and the importance of having well-educated persons to interpret her laws.

Prof. A. Crosby, of Salem, spoke of the historical associations of Haverhill, of the beautiful Lake Kenosha, in the vicinity of which was the birthplace of the great poet of Essex county, Whittier. He then alluded to the advancement observable in the town, resulting, through the progress of science, in the introduction of machinery to accomplish the work formerly done by the labor of human muscle and the outlay of human strength.

Interesting remarks were then made by the venerable Dr. Spofford, of Groveland, who had recently celebrated the 50th anniversary of his medical practice; by Hon. Warren Ordway, of Bradford, and others.

A resolution of thanks, offered by Mr. E. N. Walton, of Salem, was passed to Dr. J. R. Nichols, Moses How, Esq., and other citizens of Haverhill for their kind attentions; to the town authorities for the use of the Town Hall, and to the proprietors of the North Church for the use of their Chapel in which to hold the meeting.

The meeting then adjourned to Wednesday at noon, to meet at the rooms of the Institute in Salem, and the party took the cars for home, having spent a pleasant day in a town replete with historical reminiscences.

WEDNESDAY, JULY 3, 1867. Adjourned Meeting.

Capt. H. F. KING in the chair.

Robert W. Reeves, of Salem, was elected a Resident Member.

TUESDAY, JULY 16, 1867. Field Meeting at Andover.

This meeting was held at the South Parish in Andover. The day was fine, and a large number attended. On arrival of the special train at the depot the party went to the Town Hall, where Prof. J. H. Thayer, of the Theological Seminary, welcomed the company in a few pertinent remarks, alluding to the educational institutions in the place, and designating several objects of interest in the

neighborhood worthy of a visit. He stated that the libraries, museums, etc., of the Theological Institution would be open, as also the new Phillips Academy Building, and that the members of the Essex Institute and their friends were cordially invited to call and examine them.

Prof. Crosby, of Salem, in behalf of the Institute, expressed appreciation of the kind welcome and valuable suggestions of Mr. Thayer in reference to the interesting localities of the town.

After some explanatory remarks by Mr. F. G. Sanborn, of Andover, the company divided into small parties, and in accordance with their respective tastes started in different directions, — some to the woods and ponds in search of specimens of natural history, others to "Indian Ridge," and many to the new hall of the Theological Seminary, known as the "Brechlin Hall," recently erected through the liberality of the Messrs. Smith & Dove, extensive manufacturers in Andover, the lower floor of which is dedicated to a rare and valuable museum principally made up by contributions from the various missionaries who have gone out from the Seminary, and the second story to the valuable library, where Rev. William L. Ropes, the librarian, was very attentive and courteous to the visitors. From the tower of this hall is a most comprehensive view of the surrounding country.

The new building of the Phillips Academy was also visited; and the convenient arrangement of the various recitation, lecture, library, and apparatus rooms, etc., was much admired.

At 1 o'clock the company reassembled at the Town Hall and partook of refreshments, and at 2 o'clock the public meeting was held at the South Congregational Church, —

Dr. G. B. LORING in the chair.

On taking the chair, Dr. Loring, alluding to the town, said he liked to think of Andover as a whole before its division, and spoke in high terms of many of the earlier inhabitants. He spoke of the educational institutions of the place, whence so many earnest Christian men had gone as missionaries to nearly every part of the globe; of the enterprise of the people as pioneers in the manufacturing interests, and also in securing the advantages of railroad communication. He then briefly stated the general objects of the Essex Institute, and called for the reading of the records and the announcement of correspondence and donations.

Letters were announced from, — Samuel Agnew, Librarian Presbyterian Hist. Society, Philadelphia, Pa. (July 15); J. M. Barnard, Boston (July 15); A. J. Biggar, Ballardvale (July 13); Henry Davis, Decorah, Iowa (July 13, 15); Mrs. P. A. Hanaford, Boston (July 2); Wm. Merritt, Superintendent Boston and Maine R. R. (July 2, 13); Prof. Richard Owen, New Harmony, Ind. (July 5); Dr. B. Pickman, Boston

(July 16); J. Prescott, Supt. Eastern Railroad (July 10); S. S. Rathvon, Lancaster, Pa. (July 13); F. G. Sanborn, Andover (July 2, 10); J. Seaton, Boston (July 2); Prof. J. H. Thayer, Andover (July 16); E. W. Treadwell, Ipswich (July 2); Henri N. Woods, Rockport (July 8).

Donations to the Library and Museum were announced.

Mr. Alpheus Hyatt was introduced, and, humorously detailing a mishap by which he had become the recipient of an involuntary bath, said the circumstance had naturally suggested water as a topic upon which it might be appropriate to dilate. He thereupon gave some very entertaining and instructive talk upon this subject, saying that water was the equal of fire in its destructive power, washing down the rocks and debris from the mountain sides and in comminuting them in fine powder, which was borne down the streams, and deposited at the mouths in the form of deltas, or at the bottom of the adjoining seas, where strata are formed by successive deposits, in which are buried the remains of the various kinds of animals existing at the time. These strata are then, by some great convulsions of nature, upheaved and form the land.

Mr. Edward S. Morse gave one of his interesting talks on the mechanism of some forms of snail-shells which he described, illustrating his remarks by some very rapid but excellent drawings upon a black-board. He commenced by uttering the truth that we admire mechanism for its minuteness. While we think but little of the large derrick that raises stones, we admire the same general principles of mechanism when combined with a little watch. The brooks about here contain thirty or forty different kinds of snail-shells. The peculiarities, and different formation of these he described, one after another. He described the eyes, mouth, feelers, the tongue made up of thousands of particles and so constructed that the food was lacerated as by a file. He gave an interesting account of the process of breathing, for which purpose they ascended to the surface of the water and then went back again to the lower surface on which they had the power of moving.

Rev. Mr. Smith, the pastor of the society in whose church the meeting was held, being called upon, made some appropriate remarks. He alluded to the descriptions given by the previous speakers, as illustrating the fertility of the Creator and Sustainer of these organisms.

Prof. C. H. Hitchcock exhibited a topographical map of the two Andovers, published in 1852 before division had been effected, according to the surveys of H. F. Walling with the scale of 15000. Upon this he had attempted to represent the distribution of the different rocks over most of the area of the two towns. Upon such a large map it is better to color only the spaces occupied by the actual outcroppings, so that every one may see at a glance the proper outlines of each belt, just as correctly as the explorer. The following are the

varieties of rock in Andover: 1. Hornblende schist, including syenitic masses apparently intruded after the formation and perhaps metamorphism of the schist; 2. Gneiss, with similar patches of fine-grained granite; 3. Very coarse granite; 4. Fine mica schist.

The first group is found in the south-east part only of the towns, or south of a line drawn from near J. Farnham's in the Farnham School District to the four corners at the base of Aslebe Hill, thence probably curving below W. Jenkins' saw-mill and running to S. Cheever's in the Scotland District, thence to about the corner at the meeting of the towns of Andover, Wilmington, and Reading. Very much of this formation is properly a gneiss, with hornblende in the place of mica. Commonly the divisional planes of stratification and of joints are very even. One of the largest masses of syenite observed occupies Aslebe Hill and the territory to the east on the road to Middleton. A mile west of Gray's saw-mill the strata dip 60° N. W.

The gneiss formation includes an ugly-looking gneiss, a very ferruginous variety, quartzites in limited amount, much fine-grained granite, a bed of steatite, and perhaps other varieties worthy of notice. It occupies most of the area of the two towns, lying north-west of the hornblende rock, and limited by an overlying mica schist on the Merrimac River. South of Aslebe Hill is a fine-grained granite, not far from the steatite bed at W. Jenkins' saw-mill. The first ledge observed west of Aslebe Hill is quartzite. Patches of the fine-grained granite were noted at J. Cummings's, near Carmel Hill; in small amount at the railroad station at South Andover; near J. Adams's on the south shore of North Andover Pond; several localities south-west from the West Andover Cemetery; at about three-fourths of a mile north from West Andover church at J. Chandler's, near the Almshouse, and in many other places. There may be a synclinal structure in this formation, for at the South Andover station the dip is 80° W. 23° N., and 46° S. E. west of West Andover church. In several other places east of Shawsheen River the north-westerly dip was noticed, and it is my impression that the south-easterly dip prevails in the railroad cut in South Lawrence. Along the north-west boundary of this group there is a belt of peculiar gneiss, whose feldspar has the appearance of small pebbles. I am uncertain whether it belongs to the gneiss below or the mica schist above.

The coarse granite appears on the map like a flattened ellipse with sharp ends cutting the gneiss at an angle of about 25° . I have not searched for it south of Foster's Pond, but to the north from that point, as far as B. Rogers' in the north-east corner of the Phillips District, the outcrops are very numerous. From the middle of Scotland District to a point west of Moses Abbott's, nearly a mile and a half,

this rock forms a high precipitous ledge, of which the culminating point is Sunset Rock. The buildings of the Theological Seminary appear to be on the boundary between the coarse granite and the gneiss to the west. The most easterly outcrop of the coarse rock is near Simeon's, west of H. Gray's in the Holt District. The length of this granite is a little more than four miles; its greatest width 440 rods. The crystals of mica and feldspar are sometimes six inches broad, and are universally very large.

The mica schist is a fine-grained rock, often running into quartzite, and occupies the low land about the Merrimac River. It appears to occupy all the area 150 rods south of the river, from near the mouth of Fish Brook to Boxford. Its dip is commonly 30° - 40° north-westerly, but it is 53° N. at Daniel Butler's house. It therefore appears to lie unconformably upon the gneiss, but farther observations are needed to confirm this inference.

There is reason to believe that the gneiss and hornblende schist are of Eozoic ages, perhaps as old as the Laurentian, and hence that Andover Hill has been dry land ever since the oldest period, except when covered by the waters of the later drift. The evidence consists chiefly in the fact that pebbles of the syenite, which is newer than the schist, occur in the Paradoxides slates near Boston, along with red jasper, green porphyry, and other rocks associated with the syenite. These slates form the lowest member of the Paleozoic series; hence the rocks from which the pebbles were derived are older than the Silurian, and must be Eozoic. Lithologically they resemble the Laurentian gneiss and syenite, in the typical localities. The coarse granite being intrusive must be newer than the gneiss. The fine mica schist was at one time suspected to be Carboniferous, on account of the occurrence in it of decomposing cylindrical masses resembling the stems of trees. It is connected with the plumbaginous rock near Worcester.

Nearly the whole of the surface of Andover is covered by the coarse unmodified glacial drift. Striæ are occasionally seen on the ledges, as near Carmel Hill, with the direction (by compass) of north and south. Boulders of porphyritic granite and other rocks peculiar to New Hampshire may be found upon the highest land. Holt's or Prospect Hill, and the round hills to the north-east appear to be composed of the coarse drift, and may be the remnant of a moraine of the continental glacier.

Lying upon the older drift are the curious "Indian ridges" and "moraine terraces," both of which appear to have been deposited from water, as a cut in them invariably shows the presence of strata. According to a map by Mr. Alonzo Gray in the Transactions of the American Association of Geologists and Naturalists, the ridges are

three in number, on the west side of the Shawsheen, and the longest one and a half miles long. To the north they disappear before reaching a ridge rising between them and the Merrimac. But I have found the beginning of a ridge, overlooked heretofore, which starts behind a ledge and connects itself circuitously with the main mass. It commences at J. Tuck's in the West Centre District, pursues a slightly undulating course for 275 rods several degrees east of south, all of the way a perfect ridge; then it turns easterly and may be traced with slight interruptions past C. Shattuck's in West Andover, to join Indian Ridge near its southern termination. Moraine terraces are abundant between the Catholic cemetery and Pomp's Pond, also on the west side of the Shawsheen, south of the ridges. There is evidence to show that Haggett's Pond formerly discharged itself by a stream joining the Shawsheen near Ballardvale.

Mr. Geo. D. Phippen, of Salem, gave an interesting description of various plants collected during the forenoon, and closed by a happy comparison of the classification of plants as described by the writers of olden times, as trees, shrubs, etc., with that of the present time, which the use of the microscope had indicated.

Rev. C. R. Palmer, of Salem, made a pleasant little speech, giving some personal reminiscences of Andover, while he was fitting for college and preparing for the ministry. He spoke particularly of the pleasant and instructive walks of the town, as conducive to the health of the students.

Mr. F. G. Sanborn, of Andover, gave a brief notice of the insect fauna of Andover.

Prof. D. Crosby, of Dartmouth College, after a few general remarks, spoke of the importance of the work of the Essex Institute and its publications, especially the "American Naturalist," — which he said he had read with deep interest; the conductors of it had shown not only the possession of valuable knowledge, but a happy faculty in imparting their knowledge to others. He believed this publication would exert a powerful influence for good, and hoped it would be liberally sustained.

Prof. A. Crosby, of Salem, in response to a call from the chairman, said he did not claim to be a son of Andover, but might claim another relationship, as both his grandfathers were natives, and descendants of some of the early settlers of the town. More than a third of a century ago he had taught a Sabbath School class in the old church, while a student in the Seminary. He considered all education useful, and knowledge could and should be acquired from the study of nature as well as from books; and claimed that the Normal Schools in Massachusetts had been instrumental in developing this idea.

President Labaree, formerly of Middlebury College, spoke of the peculiar advantages and great privileges possessed by the people of Essex county; of the importance and reputation of the Theological Seminary; the character of its educational and scientific institutions; its industrial pursuits; and, in this connection, alluded to the Pacific Mills of Lawrence as having received the prize at the Paris Exposition for being the best-conducted mill.

Wm. P. Upham, Esq., of Salem, gave the dimensions of some of the large Elms of Essex county, and particularly of Andover, some of which he had that day examined.

Mr. E. N. Walton, in behalf of Mr. C. W. Felt, presented a copy of a rare and valuable book upon typographical combinations, prepared with great care, and intended as a companion volume to the one presented by Mr. Felt at the Field Meeting at Haverhill.

After a vote of thanks to the officers of the Theological Seminary, Phillips Academy, and South Congregational Church, and to the town authorities, and also to Messrs. Burnham S. White, F. G. Sanborn, Geo. S. Coles, Edwin H. Smith, T. A. Holt & Co., and others, of Andover, for courtesies extended to the members of the Institute and their friends, the meeting adjourned.

WEDNESDAY, JULY 17, 1867. Adjourned Meeting.

Judge WATERS in the chair.

A. W. Warren, of Danvers, and George W. Williams, of Salem, were elected Resident Members.

THURSDAY, AUGUST 1, 1867. Field Meeting at Beverly Farms.

This meeting was attended by nearly four hundred ladies and gentlemen from Salem, Beverly, Manchester, Gloucester, and other parts of the county. A large part of the company reached Prides' Crossing, on the Gloucester Branch Railroad, by the early morning train from Salem. Disembarking here, they separated into groups under guides familiar with the adjacent country. One of these groups rambled over the wild and elevated region known as "Beverly Commons," from the fact of its formerly having been held in common by the inhabitants of the town. This group also visited a famous bowlder of large size, peculiarly situated in the rear of the residence of Mr. Josiah Ober. A second group visited West Beach (or West's Beach, as subsequent developments indicated that it should be called), and strolled along the

seashore and through the grounds surrounding the elegant mansions in that beautiful locality.

A party of about half a dozen of the officers of the Institute left Salem early in the morning in a sail-boat, and, spending the forenoon dredging, landed at the beach in time for the meeting, to which they exhibited many of their trophies of the deep. At one o'clock the various parties rendezvoused at the village school-house, and partook of refreshments drawn from a multitude of baskets. At two o'clock the whole company gathered in the Second Baptist Church, to hear reports from the several exploring parties, and discuss the subjects of interest which might be introduced.

The meeting was called to order by

Vice-president GOODELL.

The records of the last meeting were read, and donations to the Museum and Library were announced.

Letters were announced from, — J. A. Allen, Denison, Iowa (July 25); Rev. E. C. Bolles, Portland, Me. (July 18); R. Damon, Weymouth, England (July 17); Henry Davis, Decorah, Iowa (July 23); Rev. A. B. Kendig, Davenport, Iowa (July 23); Dr. G. B. Loring, Salem (July 29); T. T. Richards, St. Louis, Mo. (July 18, 31); W. H. Roberts, New York (July 17); Prof. D. S. Sheldon, Davenport, Iowa (July 26); Rev. J. L. Sibley, Libr. Harvard University (July 30); Prof. A. E. Verrill, Yale College (July 19); Hon. A. D. White, Gloucester (July 31); W. H. Whitmore, Boston (July 31); Rev. G. D. Wildes, Salem (July 31); Charles Wright, Wethersfield, Ct. (July 30).

The Secretary read the following extract from a letter from Professor Agassiz, who had stated that he should attend the meeting if possible, but who was unavoidably prevented from being present:—

“Should I not make my appearance you may tell them, as my contribution for the meeting, that *Raja erinacea* Mitchell, not seen by any naturalist since it was first described, is quite common in our bay. It is no doubt generally overlooked owing to its small size. I begin to receive specimens, frequently, since I have been inquiring into the growth of our Skates, and requested the fishermen to bring me the smallest that they could catch. I got the first specimen from Capt. Atwood. Another interesting fact concerning the natural history of the Skates, which I have recently ascertained, is the frequency of *sterile* males and females among them, the appearance of which is so different from the normal specimens, that, in several instances, they have been described as distinct species. The most prominent differences exist in the claspers of the males. The internal sexual organs retain their embryonic condition through life, even in the largest specimens, which may equal the size of the largest fertile individuals. The characteristic spines of the males, upon the upper surface of pectoral fins, are either wanting or greatly reduced in number in the sterile males.”

Mr. C. M. Tracy, of Lynn, who accompanied the party which visited the Beverly Commons, spoke of the peculiar flora of this section of

the county, citing several examples to show that certain plants are not found in the porphyritic region of which Lynn appears to be the centre, but frequently found outside of that limit both at the north and the west. The question arises whether the underlying rocks have any influence on the vegetation growing in those localities, or whether it is owing to other causes; such are the facts. Taking up at random the several specimens lying on the table, he remarked upon their peculiar characteristics, in his usual pleasing manner, which held the close attention of the audience. Before closing, his attention was called to a beautiful specimen in flower of the *Yucca filamentosa*, brought to the meeting by Capt. Joseph Hammond, of Salem, from the celebrated nursery of Mr. J. W. Manning, of Reading. This plant is a native of the Southern States, and is sometimes known as the Adam's Needle, and will grow in Northern gardens with slight protection during winter.

Mr. Geo. D. Phippen, of Salem, spoke on the general subject of botany. He observed that all plants were in some sense wild plants, since those cultivated in one country grew spontaneously in others. More than a century ago many of our wild flowers were carried to Europe, and are now cultivated there with great success. He then spoke of the great changes in the varieties of plants produced by cultivation.

Mr. Edward S. Morse, of the dredging party, described and delineated on a blackboard the shells which the party had brought up in five fathoms of water, as well as the more common mollusks found between high and low-water mark. The habits and structure of the various species on the table were described by Mr. Morse with considerable minuteness.

Mr. Alpheus Hyatt made some remarks on the object of the investigations of naturalists. He spoke of the distribution of shells at different depths, in the same manner as certain altitudes upon the land are characterized by their peculiar plants. There was, he observed, comparatively little life in the lowest depths of water, or on the highest points of land, and the living organisms found at both extremes were generally microscopic. He closed with an interesting account of the anatomy of the common sponge.

Mr. F. W. Putnam exhibited a live salamander, which had been found by some of the party. This species was often, he said, confounded with the lizard, from which, however, it widely differed, although a casual observer might fancy a resemblance.

Mr. Putnam also exhibited living specimens of the young "lump-sucker" or "sucking-fish," and a live specimen of a species of *Liparis* which had not before been found in the waters of our bay. This speci-

men was dredged during the forenoon off the Misery. It was very different from the single species of *Liparis* which had heretofore been found in Massachusetts waters.

Mr. Joseph E. Ober, of Beverly Farms, gave the following account of West's Beach :—

West's Beach took its name from John West, the first settler of Beverly Farms; this is evident from the fact, that John West bought the land adjacent to the beach of John Blackleach of Boston, who held said lands by a grant from the town of Salem.

In the Essex County Registry of Deeds, book 2, page 89, dated Dec. 14, 1660, is a deed recorded "conveying to John West at the Creek, in consideration of £350, all that messuage, uplands and meadow, situate and lying in Salem aforesaid, as hath been at any time or times before the day of the date hereof, been given and granted unto the said John Blackleach, formerly in the name of Lawrence Leach, but now in the name and occupied by John West."

The following is from the Ancient Town Records of Salem :— "At a meeting of the selectmen 19th day of 12th month 1666, It is agreed with John West at the Creek yt whylst hee shall mayntayne the Causeway over the Marsh at the farme which was Mr. Blackleach in Salem Bounds, a sufficient hie waye to the town of Gloster and the Manchester mens use; hee shall enjoy the use and benefit of all such ground which lyeth in Common between the sayed farme and the farme of Nicholas Woodberry, with Pond and Beach, and hath liberty to set up a gate thereon for his use, any former records nulled."

1668, 10th month, 8th day, John West and wife Mary, together with their son Thomas and his wife Elizabeth were, upon letters of dismission from the church in Ipswich, received into communion with the church in Beverly.

The children of John West were John, Joseph, and Thomas (John and Joseph died young and unmarried). Thomas married Elizabeth Johnson (daughter of John and Catherine Johnson), by whom he had nine children, four of whom died young and unmarried; of the others, Ruth married William Haskell in 1668, and has numerous posterity at the Farms and elsewhere; Samuel married Mary Norton, had eight children, most of whom were married and have posterity settled all over New England. Mary married Robert Woodberry, and has an extensive posterity. Thomas married Christianna Woodberry. Christianna Woodberry (or West) inherited a large tract of woodland lying in Manchester near the Beverly line, which has ever since been known as *Christian's Hill*. In book 92 of the Essex Registry of Deeds, page 87, may be found a record of a deed dated in those early times, of certain beach lands and flats, being a part of the beach known as West's Beach.

For a great number of years the causeway, named in the original grant to John West from the town of Salem, was kept in repair by the heirs of said West. They were so particular with regard to complying with said grant, that they divided and subdivided the causeway which was twenty-two rods long, according to each heir's respective part or share to maintain and keep in repair. It is a fact little known, perhaps, outside the limits of the town of Beverly, that this same causeway has, from those early times, been kept in repair by individuals up to 1852, when the legislature granted an act of incorpo-

ration known by the name of West's Beach. This West's Beach Corporation is regularly constituted, their annual meetings regularly held, and a record kept of all their doings; in fine, the fulfilling of the original grant before referred to is looked upon by some at the Farms as almost sacred.

Rev. A. P. Peabody, D. D., of Harvard University (a native of Beverly), was the next speaker. He was interested in the pursuits of the Institute and its prosperity. He said these field meetings were of value, as educating the mind through the senses, inducing a habit of observation and of accuracy, extending its influence to all departments of knowledge, and leading the human mind into unison with the spiritual and divine.

Mr. R. S. Rantoul, of Salem, read some extracts from a journal kept by Gov. Winthrop in 1630, during his passage in the *Arabella*, giving an account of the landing of his party at this place in 1630.

Mr. E. N. Walton, of Salem, spoke of the great hail-storm which visited Salem fifty-two years ago, on the first day of August, 1815, when, according to the *Essex Register* issued on the following day, after an uncommon succession of warm days with repeated appearances of wild and irregular clouds, a hail-storm burst upon the town and continued for twenty minutes with great fury, doing great damage. The stones were of an oblate figure, and many of them upon their broader surfaces were an inch in diameter. The storm was preceded by a continued rumbling of distant thunder in the south-west, and a darkening sky, but there was no remarkable lightning or thunder after the hail began to fall. The territory visited by the storm was quite limited. It did not reach Beverly or Lynn, and only a small part of Danvers; even in Bridge street, in Salem, the shower was hardly felt, in comparison with other places. In Marblehead the storm was violent, and great destruction was caused in gardens and fields, and much glass was broken. At the Derby farm, in Salem, the storm was specially severe, and 3,350 panes of glass were broken.

Mr. Timothy Ropes, of Salem, followed, giving particulars of the hail-storm, from memory. He was then a boy, but he had a vivid recollection of the general terror and of the great havoc produced by the visitation.

Dr. Henry Wheatland stated that there was among the Institute collections a manuscript record giving the names of individuals on whose premises glass had been broken by this hail-storm, stating the number of panes and size of glass lost by each. It seems that in Salem alone there were one hundred twenty-six thousand two hundred and eleven panes broken, of which number 74,561 panes were of 7 by 9 inch size.

The thanks of the Institute were voted to Messrs. T. M. Standley,

John Larcom, J. L. Ober, Jesse E. Ober, I. S. Day, E. Pride, C. C. Paine, Wm. Paine, Franklin Haven, Chas. G. Loring, C. W. Loring, R. S. Rantoul, T. A. Neal, Jonathan Preston, Josiah Ober, Isaac Smith, A. Haskell, Joel Kimball, John H. Larcom, E. A. Boardman, R. W. Hooper, and to Miss Maria Neal, for courtesies extended to the members and friends of the Institute; and also to the proprietors of the Second Baptist Church for the use of their church for the holding of the meeting.

FRIDAY, AUGUST 2, 1867. Adjourned Meeting.

S. P. WALCOTT, Esq., in the chair.

Amos Hazeltine, jr., of Haverhill, and Preston Marshall Chase, of Danvers, were elected Resident Members.

THURSDAY, AUGUST 22, 1867. Field Meeting at Kittery, Maine.

For the first time in its history the Essex Institute held a Field Meeting beyond the limits of the Commonwealth, and invaded Kittery, Me., a locality rich in historical associations and objects of interest. The party was large, numbering some four hundred and fifty from the vicinity of Salem, and increased to about six hundred upon arriving at Kittery.

The forenoon, as usual, was spent in rambling and visiting the places of interest, the naturalists betaking themselves to the woods and waters in search of specimens for presentation at the afternoon meeting. The chief points of attraction were the U. S. Navy Yard, and the ancient estates of Sir William Pepperrell, the commander of the forces at the capture of Louisburg, Cape Breton, in 1745; the wealthiest and most eminent merchant of his day, the first native of New England ever made a Baronet of Great Britain; connected with Massachusetts, Essex county, and Salem by many ties, and of whom a full-length, original portrait of life size has for nearly fifty years been the most prominent picture in the gallery of the Essex Historical Society and the Essex Institute, into which the old society became merged.

The ancient Pepperrell mansion is at Kittery Point, four miles from the railroad station. It was built by the father of Sir William about the year 1680. Here the son was born in 1696, and when he was married, in 1723, he took his bride to the family mansion, which was enlarged at that time by an addition to the north end, giving the whole a stately appearance. Those who would learn the full details of Sir William's career are referred to an admirable biographical sketch by

the late Geo. A. Ward, Esq., of Salem, in the Appendix to his Journal and Letters of Samuel Curwen, and to a more elaborate biography by the venerable Dr. Usher Parsons, now the sole surviving officer of Perry's brilliant naval victory on Lake Erie, who was expected to be present on this occasion, but, unfortunately for the Institute, was prevented from attending. To these works, and to Charles W. Brewster, Esq., the editor of the Portsmouth Journal and author of "Rambles about Portsmouth," who personally accompanied the party and contributed greatly to the interest of the visit by his knowledge of the localities and the historical associations connected with them, we are indebted for our facts.

The ride to the Point, through Kittery Foreside, though rough and in crowded vehicles, was full of interest. The road follows the course of the Piscataqua and affords views of Portsmouth on the opposite side of the river, and of the Navy Yard close at hand, and passes by the old garrison-house, now modernized, built for protection against the Indians; the ancient graveyard containing many quaint inscriptions, affording material for curious study; the antique parsonage, where the mother of Rev. Joseph Stevens Buckminster was born, with the church adjoining; the dilapidated mansion built by Lady Pepperrell after her husband's death, and the Sparhawk mansion erected by Sir William for his daughter upon her marriage. Just before reaching the Point, Spruce Creek is crossed, and the new Fort McClary comes into view, a massive fortification not yet completed, which, with Fort Constitution on the other side (plainly in sight with Newcastle in the background and the Isles of Shoals nine miles seaward), will protect the mouth of the river and the entrance to the Navy Yard.

The Pepperrell Mansion shows but little of its former grandeur. One room and the spacious hall, or entry, remain pretty much as they were in Sir William's day, and indicate the courtly style in which he lived; but the house has been curtailed in its dimensions, and its surroundings are not what they were. It is still a comfortable residence, however, and a most interesting relic, and nothing could exceed the kindness and courtesy of Mrs. Bellamy, in welcoming this intrusion of strangers into her family mansion, and in her efforts to make their visit agreeable and satisfactory. She exhibited to them several articles of interest, and seemed never weary of answering questions and giving explanations. Her politeness was highly appreciated.

Mr. Ward describes the old mansion as plain in architecture, but containing a great many rooms, and well adapted to the extensive domains and hospitalities of its former owners. The lawn in front (now, in part, a kitchen garden) extends to the sea, and the restless waves, over which Sir William sought fortune and fame, still glitter in the

sunbeams and dash around the abode. The hall is spacious and well finished; the ceiling ornamented, and the richly carved banisters bear traces of former elegance. On ascending the staircase, paintings of angels' heads decorate the hall window. In this mansion, where he was born, and died, the Baronet always lived suitably to his rank, and extended hospitality to the numerous visitors who flocked to see and converse with the victor of Louisburg. His walls were hung with costly mirrors and paintings; his sideboards and cellars were filled with the choicest viands, and his park stocked with deer. He had a retinue of servants, costly equipage, and a splendid barge with liveried oarsmen. His dress was of the expensive kind worn by the noblemen of that day,—scarlet broadcloth trimmed with gold lace, a cocked hat similarly trimmed, and a large powdered wig,—as he is represented in the portrait which hangs in the hall of the Institute. At the meeting a lady exhibited a rich satin vest formerly worn by Sir William, and the high-heeled satin shoes which belonged to his wife.

Sir William owned real estate in nearly every town on the seaboard from Hampton to Portland, and also in the towns bordering on the Piscataqua River. It is said that he could travel from the Piscataqua to Saco Rivers, nearly thirty miles, on his own soil. In Saco alone he owned 5,500 acres, including the site of that populous town and its factories. But all his vast fortune was dissipated and scattered at the time of the Revolution. His grandson, who inherited the bulk of it, took the loyalist side, and the property was confiscated by the legislative act of 1778. No descendant bearing the Pepperrell name is now living. The splendid service of plate presented to Sir William for his conquest of Louisburg was exempted from confiscation, and was sent under guard to Boston for shipment to England, whither his exiled heir had gone. Sir William's Louisburg service sword is in the possession of Dr. Parsons. Another sword, richly mounted with gold and jewels, given him by Admiral Sir Peter Warren, is in the possession of Dr. Jarvis, of Claremont, N. H. A superb gold snuff-box, having upon the cover, in bas relief, a representation of the interview between Alexander and Diogenes, presented to him by King George II, was owned by Mr. Ward.

The Pepperrell tomb is in a field in the rear of the mansion, and contains the remains of Sir William and Lady Pepperrell, his father and mother, and many members and servants of the family, now mingled in an indiscriminate mass. A few years ago it became greatly dilapidated, and but for the respect entertained for the memory of the illustrious dead, by a female remotely descended from the baronet, the whole structure would long since have fallen into ruins. By her exertions and limited means the tomb was put in good repair. The

marble structure that now stands over the vault was erected by Sir William in 1736, soon after the death of his father. It was ordered from London, and cost, when completed, £34 11s. 4d. It bears upon the top the Pepperrell arms, which are described in the Herald's Office as "argent a chevron gules between three pine apples, slipt vert. No crest is to be found to the above-mentioned arms, being an ancient coat before crests were used." Beneath the coat of arms is the following inscription :

Here lyes the body of the Honourable
WILLIAM PEPPERRELL Esq
who departed this Life the 15th Feb'y
Anno Domini 1733. In the 87th Year
of his Age.
with the Remains of great part of
his Family.

No inscription in memory of Sir William himself or any other of the family has ever been added. Sir William was born in 1696, and died in 1759. Dr. Parsons states that his funeral obsequies were attended by a vast concourse. The drooping flags at half mast on both shores of the Piscataqua, the solemn knell from neighboring churches, the responsive minute-guns from all the batteries, and the mournful rumbling of muffled drums announced that a great man had fallen and was descending to the tomb. The funeral discourse, preached by Rev. Dr. Stevens on the next Sabbath, was published by Lady Pepperrell, and a copy sent to each member of the house and council. He was chosen a member of the Massachusetts legislature from Kittery in 1726, and the next year was appointed a Councillor, the appointment being renewed, until his death, for thirty-two successive years, during eighteen of which he served as President of the Board.

In the field containing the tomb, and but a short distance from it, is a single small slate grave-stone, bearing on the top a death's head, rudely carved, and having this inscription :

Miriam Jackson
Dau'r to George
& Joanah
Jackson aged
17 days Died
Aug't ye 11th 1720

This was undoubtedly a child of Sir William's elder sister, Joanah, who was born in 1692, married Dr. George Jackson, and died in 1725.

Lady Pepperrell survived her husband for thirty years, until 1789. After Sir William's death she left the old mansion and built a neat house in more modern style, near that of her daughter, Mrs. Sparhawk (hereafter alluded to), and the village church, and here she died.

This house appears to be more dilapidated than either of the others, but only the outside of the premises was visible to the party on Thursday.

Upon returning from Kittery Point the company visited the mansion erected for the residence of Sir William's daughter Elizabeth, a famous belle and heiress, highly accomplished, who was married to Nathaniel Sparhawk in 1742. This house was apparently superior in style to the old mansion. It is now undergoing repairs, the present occupants having been only a few weeks in possession. Here, too, the intruders were politely received and afforded every facility for examining the premises. The spacious hall retains its original form and the walls their ancient paper, which must have been of rare richness and costliness. One of the rooms is still, in general appearance, very much the same as when occupied by the Sparhawks. The chimney-piece, with its little, square, porcelain, pictured tiles, covered with colored birds and quaint devices, is almost as perfect as ever. In another room is one of the old-fashioned "buffets," or cup-boards, curiously fashioned and well preserved, which, could it speak, would doubtless reveal the secrets of many a banqueting scene where the courtly ladies and gentlemen of the last century figured. A few years ago there was a fine avenue of trees leading to this house, and a portion of the tessellated pavement in front is still preserved. When in its prime the large walls of the entrance hall were covered with portraits of the Pepperrell and Sparhawk families, and of the friends and companions in arms of Sir William. Some of these are now in the possession of Rev. Dr. Burroughs of Portsmouth.

Sir William in his day must have frequently visited Salem and Danvers. His sister Mary married for her third husband Rev. Benjamin Prescott, of Danvers, and in his journeys to and from Boston he no doubt was accustomed to stop there. He certainly did in the spring of 1759, the year of his death. Upon his return from Louisburg he was received in Boston with great pomp, and on the 4th of July, 1746, attended by divers officers and gentlemen, set out for his seat in Kittery. He was met at Lynn by a troop of horse and entertained, and was there received by a company of gentlemen and conducted to Salem, on entering which he was saluted with cannon and ringing of bells, and conducted to the town hall to partake of a magnificent entertainment. After dinner the royal healths were drank, Gov. Shirley's, Sir William's, Admiral Warren's, Brigadier Waldo's, and those of all the officers and men at the siege of Cape Breton; at each health the cannon were fired, and a treble discharge made by the troop of horse. On leaving the Beverly ferry a cavalcade met him from Ipswich and Newbury, and so he made a triumphal progress home, being everywhere received with extraordinary honors.

The portrait of Sir William in the possession of the Institute was received by the Historical Society in 1821 from William P. Sparhawk, Esq., of Kittery, a nephew of the last Sir William, and a great-grandson of the hero of Louisburg, Lieut. General Sir William Pepperrell, Baronet.

A visit to the Navy Yard was not the least interesting of the incidents of the day. By the courtesy of Admiral Bailey, every part of the premises was open to inspection, and officers and men everywhere were polite and cordial in their attentions. The greatest neatness and order pervaded every department, and the visitors were exceedingly gratified with their inspection. The boat shop, the machine shop, the massive plates for the iron-clads, the dry dock, the depots of clothing and provisions, the sail-loft, the vessels, and the ordnance building, received due attention and excited the greatest admiration, which culminated in the armory, from which the ships of war are supplied with small arms, and which contains every species of weapon used by the men-of-war's men, arranged with the most exquisite skill and taste, and polished to the highest degree of perfection. Here were Dahlgren howitzers, rifles, carbines, pistols, cutlasses, of almost every conceivable pattern, old and new, boarding-pikes, etc., with a few relics of interest. A courteous attendant explained everything, and took great pains to make the visit agreeable. Nothing could exceed the neatness which every visible object presented, and the grand array, though on a smaller scale, brought forcibly to mind the memorable verses of Longfellow relative to the Springfield Arsenal.

At half past one o'clock the parties had mostly reassembled at the hall of the stockholders of the Portland, Saco, and Portsmouth Railroad, the Directors of which, as well as those of the Eastern Railroad, used every effort to accommodate the company. Divine blessing was invoked by the Rev. Mr. Swan of Kennebunk, and the large party soon disposed of the viands on the tables, which were then cleared away and their place occupied with settees, when the meeting was called to order with

Vice-president GOODELL in the chair.

Mr. Goodell opened the meeting with a few remarks on the character and object of the field meetings, and called for the reading of the records of the last meeting.

Donations to the Library and Museum were announced by the Secretary and Superintendent of the Museum.

Letters were announced from, — John Akhurst, Brooklyn, N. Y. (Aug. 21); Capt. N. E. Atwood, Provincetown (Aug. 1); Mrs. Charles G. Bellamy, Kittery, Me. (Aug. 17); Rev. E. C. Boiles, Portland, Me. (July 22, Aug. 20); Buffalo Historical Society (Aug. 8); G. F. Calef, Saco, Me. (Aug. 15); Com. Stephen Decatur, Kittery, Me. (Aug. 15);

W. L. Dwight, Portsmouth, N. H. (Aug. 16); J. F. Fellows, Collector's Office, Boston (Aug. 2); Prof. Asa Gray, Columbus, Ohio (Aug. 1); Warren Humiston, Otter Creek, Ill. (Aug. 10); John Krider, Philadelphia, Pa. (Aug. 21); Prof. Daniel Merriman, Andover (Aug. 2); Dr. Usher Parsons, Providence, R. I. (Aug. 14); Peabody Institute, South Danvers (Aug. 3); Pennsylvania Historical Society, Philadelphia, Pa. (Aug. 5); Portland Society of Natural History (Aug. 6); F. W. Putnam, Bethel, Me. (Aug. 14); Moses W. Putnam, Haverhill (Aug. 10); Rhode Island Historical Society, Providence (Aug. 5); E. A. Samuels, Boston (Aug. 21); Prof. D. S. Sheldon, Davenport, Iowa (Aug. 21); G. W. Smith, Grand Rapids, Mich. (Aug. 2); M. A. Stickney, Danvers (July 23); Prof. H. C. Wood, jr., Philadelphia, Pa. (Aug. 20); Corporation of Yale College, New Haven, Ct. (Aug. 7); York Institute, Saco, Me. (Aug. 6).

Mr. Cyrus M. Tracy, of Lynn, was called up to discourse on the botanical specimens. In an easy and natural method he turned from one specimen to another, pointing out its peculiarities and where it differed from specimens from the same species found in Essex county. He had never been in this region before, but he was struck with the variations in the flora. The flowering raspberry is sometimes found in gardens in Essex country, where it is cultivated for its flowers, but there it never bears fruit. Here he finds it growing wild with fruit matured, of which specimens were before him. The larch was a tree just creeping into the region of Lynn, but here the thickets were full of it, and further to the east the trees were large. The beech is a tree of comparative rarity in Essex county, where it seldom ripens its fruit. Here was a specimen with the fruit well filled. He then took up the flowering plants of the season, that were substantially the same, the golden rod, with its varieties, hog peanut, leafy spurge, everlasting, rattlesnake weeds, and thistles. A splendid cultivated specimen of the latter, with variegated leaf, was shown, but a full statement of its botanical history was not given. Mr. Tracy's method of talking about plants is so pleasant and his matter so instructive, that one could not help wishing that our lyceums would avail themselves of his instruction instead of the wish-wash they take from many professional lecturers.

Mr. F. W. Putnam spoke of several specimens that had been collected during the morning, and especially of the Checkered Adder, which he stated to be perfectly harmless, and showed how it differed from the Rattlesnake and the Copper-head, the only poisonous snakes in New England. He then explained the peculiar structure and formation of the egg-case of the Skate, and gave an account of the development of this fish.

Dr. Elliott Coues, of the United States Army, was called upon, and took for his theme the genus *homo*, or that part of it which is native to Arizona Territory, the Apache Indian. The Dr. gave a very unfavor-

able account of this "noble" denizen of the forest. The word *Apaché* means outsider, or barbarian, and was applied to these Indians by the early Jesuit missionaries, because they were not susceptible to any influences of civilization. The Apaché was small in stature and thick-set, never cuts or combs his hair, but wears it in a mat, and on the whole is as repulsive a creature as can well be conceived of. He carries a bow six feet long, and for the point of his arrow he inserts in a reed a sharp piece of stone, which is left in the wound, and as this is often poisoned, a wound is likely to be fatal. Other tribes, more promising, were described, but it was the Doctor's opinion that the only way to manage the Apaché fellows was to exterminate them, and that is easier said than done. They are supposed to number 10,000, and many of them are well mounted and live in the fastnesses of the mountains, and by their incursions range a wide extent of country. But the question is coming to this, — Apaché or Pacific Railroad; we can have one, but he thought it doubtful if we could have both.

Rev. E. C. Bolles, of Portland, spoke for the Portland Natural History Society. He regretted that so few were present from that city, and alluded to the loss of the society's cabinet at the great fire in July, 1866. He then gave an interesting discourse on the subject of microscopic fungi, which he illustrated by the use of the black-board.

Mr. Edward S. Morse, with the aid of his ever ready chalk and black-board, gave an account of the anatomy of several species of minute shells that had been collected.

Rev. Joseph Banvard, of Paterson, N. J., responded for a new society there recently founded on the pattern of the Essex Institute.

Rev. Mr. Wildes, of Salem, regretted that the time had so nearly expired, as not to allow of his speaking of historical matters connected with the locality.

The venerable Captain Decatur, U. S. N., who resides at Kittery, was present at the meeting, and seemed to enter fully into its spirit, though now deprived of his sight.

On motion of Rev. Mr. Wildes, of Salem, the thanks of the Institute were voted to Hon. I. Goodwin, of Portsmouth, and to the Board of Directors of the Portland, Saco, and Portsmouth Railroad for the use of their building during the day, and for other courtesies; to Messrs. H. L. Williams, W. L. Dwight, and the directors and officers of the Eastern Railroad Company for attentions to members and their friends; and to Mrs. C. J. Bellamy and Captain Stephen Decatur for their kind attentions.

At five o'clock the special train arrived to take the excursionists to their homes. The weather had been delightful, and the Field Day of

August, 1867, will be remembered as an occasion of unmixed pleasure to all who were present.

MONDAY, SEPTEMBER 2, 1867. Regular Meeting.

S. B. BUTTRICK, Esq., in the chair.

Moses W. Putnam, of Haverhill, and Mary C. Hoyet, of Beverly, were elected Resident Members.

MONDAY, SEPTEMBER 16, 1867. Regular Meeting.

S. B. BUTTRICK, Esq., in the chair.

Henry E. Pope, Henry L. Williams, and Daniel F. Meady, of Salem; and Henry A. Breed, of Lynn, were elected Resident Members.

*Additions to the Museum and Library during July,
August, and September, 1867.*

TO THE NATURAL HISTORY DEPARTMENT.

BY DONATION.

BAILEY, Prof. L. W., Fredericton, N. B. A collection of Minerals and Fossils from New Brunswick.

CHITTENDEN, L. E., New York. Living specimens of *Lymnæa megasoma*, from Burlington, Vt.

COLCORD, Mrs. H. M., South Danvers. A Wasps' Nest from Danvers.

CROSBY, Prof. A., Salem. A Caterpillar from the Grape-vine.

DAVIS, CHARLES, Beverly. A specimen of *Gelasimus vocans* from Providence, R. I.

DAVIS, HENRY, McGregor, Iowa. A collection of Fossils from Iowa.

DIXON, Miss SARAH, Danville, Va. Specimens of Algae from the German Ocean.

EMERTON, J. H., Salem. Specimens of larva of a *Carabidid* from Haverhill, and the larvæ of a salt-water *Tipulid* from Salem Harbor.

EMMERTON, EPHRAIM, Salem. Two specimens of a Fungus from Salem.

FARNSWORTH, P., New York. A Salamander from Jeffrey, New Hampshire.

FREEMAN, TRUMAN, Salem. A specimen of *Gordius aquaticus* from Salem.

GRINDALL, HERBERT W., Salem. Larvæ of Grape-vine Moth from Salem.

HARRINGTON, Capt. GEORGE, Salem. A collection of Birds, Reptiles, and Insects from Zanzibar, E. C. Africa.

HARVEY, Rev. A. B., South Danvers. A collection of Fossils from New York, and an Egg Case containing a young Skate from Swampscott.

HATHORNE, Capt. WILLIAM, Salem. One Chameleon, two Geckos, and a specimen of *Mygale* from Zanzibar, E. C. Africa.

HAWN, Major F., Leavenworth, Kansas. Specimens of *Colopternus femur-rubrum*, collected in various stages of growth, from Leavenworth City, Kansas.

KERR, Prof. W. C., Raleigh, N. C. Specimens of *Palæotrochis minor* Emm. from the Lower Taconic beds of North Carolina.

LARABEE, JOS., Salem. A portion of one of the Vertebra of a Whale, found while digging at the new Gasometer on North street.

LARCOM, JOHN, Beverly. A specimen of *Gordius aquaticus* from Beverly.

MORGAN, B., Manchester. A specimen of *Astrophyton Agassizii* from George's Bank.

MORSE, E. S., Salem. Bones, Shells, etc., from the shell-heaps at Goose Island, Casco Bay.

NEAL, GEORGE, Salem. A fresh specimen of Blue Heron from the vicinity of Salem.

PACKARD, Dr. A. S., jr., Salem. Quarternary Fossils from Port Kent; Fossils from Ausable Chasm, Port Kent; Insects from the Adirondack Mountains, N. Y.; specimens of *Mycetobia*, in all its stages, and a collection of various injurious larvæ from Salem.

PARKER, WILLIAM B., Salem. A Fungus from New London, N. H.

PARKS, Wm. H., Para, Brazil. A Centipede from Para; one Snake, several specimens of Crustacea, and the larva of a Beetle, from Nauta, Amazon River.

PERKINS, Dr. G. A., Salem. Eggs and young of a Hemipterous Insect, and wax scales of the Honey Bee.

PERKINS, Hon. J. C., Salem. Two specimens of *Helix cellaria* from Salem.

PICKMAN, H. D., Boston. A collection of Fossils and Minerals from Hillsboro', Albert county, N. B.

PUTNAM, F. W., Salem. Insects from Burlington, Vt.; a collection of Fishes and Mollusks from Lake Champlain, at Westport, N. Y.; specimens of *Gordius aquaticus* from Westport; and Minerals from

various localities; Fishes from a tributary of the Androscoggin River at Bethel, Me., and specimens of *Paludina decisa* from the vicinity of Bethel.

RICHARDS, LEWIS D., Salem. A larva of the Grape-vine Moth from Salem.

ROBERTS, W. S., Salem. Cells containing larvæ of the Leaf-cutting Bee from Salem.

SANBORN, F. G., Boston. A *Cottoid* from Ausable Lake, N. Y., and three Salamanders from Keene, N. Y.

SHEPARD, H. F., Salem. A Fish-hawk and a Spotted Sandpiper from the vicinity of Salem; Oysters from the sunken Temple of Jupiter Serapis, and seeds of the edible Pine from Rome; two specimens of Coral from Baker's Island, Pacific Ocean.

SMITHSONIAN INSTITUTION, Washington, D. C. Skin of *Lepus campestris* from British America; twenty-five skins of arctic Birds, and thirty-four Nests and Eggs of North American Birds.

STEVENS, WILLIAM H., Salem. A specimen of the Brown Bat from Salem.

STORY, A. E. Beverly. A specimen of Dragon Fly taken in Salem.

TRASK, AMOS, Salem. A specimen of Hoary Bat from Kittery, Me.

VERRILL, Prof. A. E., Yale College. Iron Ores from the Hecla Mine, Elizabethtown, N. Y.; and the Ætna Mine, Essex county, N. Y.

WARD, JAMES L., Salem. A fresh specimen of Night Hawk killed in Salem.

WILLEY, H. A specimen of *Asplenium thelypteroides* Mich., from Genesee, N. Y.

TO THE HISTORICAL DEPARTMENT.

BY DONATION.

GROVER, JAMES, Salem. A high-heeled Shoe one hundred years old, and a Clothes Pin made in Dartmoor Prison.

SHEPARD, H. F., Salem. Hair-pins used by the natives on the East Coast of Africa; Portrait in oil of Said Syed, Imaum of Muscat, copied from the original painted by Lieut. Linch; a collection of various European Coins; a Half Cent of 1856; Relics from Herculaneum.

SAUNDERS, ALONZO C., Haverhill. An Indian Pestle made of stone, found in Haverhill.

UNKNOWN. A piece of the root of the Tree on which the Witches were hung in Salem.

WILLIAMS, WM. O., Salem. Portfire Case, and two Portfires taken at Fort St. Phillip.

TO THE LIBRARY.

BY DONATION.

ANGELL, JAMES B., University of Vermont. *Catalogus Univ.*, 1867, 8vo, pamphlet.

APPLETON, W. S., Boston. *Ancestry of Mary Oliver*, by W. S. Appleton, 1 vol. small 4to, Cambridge, 1867.

BUTLER, B. F., M. C. *Remarks of G. S. Boutwell, B. F. Butler, and T. Williams on the President's Veto, July 19, 1867*, 8vo, pamphlet.

COPE, EDWARD D., Haverford College, Pa. *Report of Haverford College*, 1867, 8vo, pamphlet.

CROSBY, A. *Catalogus Coll. Dart.*, 8vo, pamph., Hanover, 1867. *Catalogue of Dartmouth College*, 1866-7, 8vo, pamphlet. *Catalogue of Phi Beta Kappa of New Haven*, 1867, 8vo, pamphlet.

DOWNING, E. H. *The Methodist Church Property Case*, by R. Sutton, 1 vol. 8vo, Richmond, 1851. *Reid's Essays on the Active Powers of Man*, 1 vol. 8vo, Philadelphia, 1818. *Ives, The Trials of a Mind in the progress of Catholicism*, 1 vol. 12mo, Boston, 1854. *Massillon's Sermons*, Willett's ed., 1 vol. 8vo, Boston, 1845. *Wardlaw's Christian Ethics*, 1 vol., New York, 1835. *Foster's Critical Essays*, 2 vols. 12mo, London, 1856 (Bohn's Standard Library).

DROWNE, CHARLES, Troy, N. Y. *Annual Register of Rensselaer Polytechnic Institute*, 1866-67, 8vo, pamph., Troy, 1867.

FARNUM, JOSEPH. 40 Pamphlets.

HART, HIRAM S., Burlington, Vt. *Burlington City Directory for 1865-6, 1866-7, 1867-8*, 3 vols. 12mo, Burlington, 1865, etc.

HOLMES, JOHN C. *Fifteenth Annual Report Board of Water Commissioners of Detroit for 1866*, 8vo, pamph., Detroit, 1867. *Annual Report of Board of Water Commissioners of Detroit*, 8vo, pamph., 1866. *Fifth Annual Report of Secretary of Board of Agriculture*, March, 1866, 1 vol. 8vo, Lansing, 1866.

HUBBERT, JAMES, Montreal. *Hubbert's Catalogue of the Flowering Plants and Ferns of Canada*, 8vo, pamph., Montreal, 1867.

JOHNSON, JOHN G., Philadelphia. *A Criticism of Wm. B. Reed's Aspersions on the Character of Dr. B. Rush*, 8vo, pamph., Philadelphia, 1867.

KING, H. F. *Fourth Annual Report of Old Colony and Newport Railroad*, 8vo, pamphlet. *Life of Emanuel Swedenborg*, 1 vol. 8vo, Boston.

LANGWORTHY, I. P., Boston. 96 Pamphlets.

LORD, N. J. *Files of Boston Post*, April, May, and June, 1867.

MANN, HORACE, Cambridge. *Enumeration of Hawaiian Plants*, by Horace Mann, 8vo, pamph., Cambridge, 1867.

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23

JUNE, 1868.

MORSE, EDWARD S. Portland Directory, 1863-4, 1 vol. 12mo, Portland, 1863.

MUDGE, B. F. Manhattan, Kansas. Third Annual Catalogue of Officers and Students of Kansas State Agricultural College, 8vo, pamph., Manhattan, 1867. Sixth Annual Report of Superintendent of Public Instruction of Kansas, 8vo, pamph., Leavenworth, 1867.

PACKARD, A. S., Brunswick, Me. Bowdoin in the War, 8vo, pamph., Brunswick, 1867.

PARSONS, CHARLES W., Providence, R. I. Rhode Island Registration Reports for 1855, 1857, 1858, 1861, 1863, 1865, 6 pamphlets, 8vo, Providence. Butler Hospital for the Insane, Reports for 1858 to 1866, 8 pamphlets, 8vo, Providence. Parsons, C. W., Report on Medical Topography, etc., in Rhode Island, 8vo, pamph., Philadelphia, 1864. Parsons, U., Sketches of Rhode Island Physicians, 8vo, pamph., Providence, 1859. Parsons, U., Indian Names of places in Rhode Island, 8vo, pamph., Providence, 1861. Providence Directory for 1865, 1 vol. 8vo, Providence, 1865.

PERKINS, HENRY, Philadelphia. Revised Report of the Select Committee relative to the Soldiers' National Cemetery at Gettysburg, Pa. 1 vol. 8vo, Harrisburg, 1865.

RICE, WILLIAM, Springfield. Report of Springfield City Library Association, 8vo, pamph., Springfield, 1867. Annual Report of Springfield City Library Association, 8vo, pamph., Springfield, 1867.

ROPES, W. L., Andover. Triennial Catalogue of Andover Theological Seminary, 1867, 8vo, pamphlet.

SHEAFER, P. W., Pottsville, Pa. Use of Anthracite Coal as a Fuel, by W. P. Sheaffer, 8vo, pamphlet.

- SHEPARD, HENRY F. Henshaw's Communicants' Guide, 1 vol. 12mo, Baltimore, 1831. Leslie's Behaviour Book, 1 vol. 12mo, Philadelphia, 1854. Radicalism, four papers from Boston Courier, 1 vol. 12mo, Boston, 1858. Memoirs of Rev. Ammi Rogers, 1 vol. 12mo, Middlebury, Vt., 1830. Bennett's Letters, 2 vols. 12mo, London, 1812. Girault's Vie de Washington, 1 vol. 16mo, Philadelphia, 1849. Marmontel's Moral Tales, 1 vol. 8vo, Manchester. Revised Statutes of Massachusetts, 1 vol. 8vo, Boston, 1836. Quincy's Memoir of J. Quincy, Jr., 1 vol. 8vo, Boston, 1825. United States Tax Bill, 1 vol. 8vo, Boston, 1862. 23 Pamphlets. Report on Light-houses, 1 vol. 8vo, Washington, 1852. Message of President United States, on British Recruitment, 1 vol. 8vo, Washington, 1856. Maury's Sailing Directions, 3d ed., 1 vol. 4to, Washington, 1851.

SMILEY, JAMES V., Haverhill. Haverhill and Bradford Directory, 1860-61, 1 vol. 12mo.

SUMNER, CHARLES, U. S. Senate. Monthly Report of Department

of Agriculture, May and June, 1868, 8vo, pamph. Navy Register U. S. for 1867, 8vo, pamph., Washington, 1867. Lanman's Dictionary of Congress, 1 vol. 8vo, Washington, 1866. Acts of U. S. Congress, second session 39th, first session 40th, Dec. 3, 1866 to March 30, 1867, 8vo, pamphlet. Speeches in U. S. Senate by Chandler and Nye, July 12, 1867, 8vo, pamphlet.

TENNEY, E. P., Manchester. Price's Chronological History of Boscawen, 8vo, pamphlet, Concord, 1823. Willey's Historical Discourses at San Francisco, March, 1859, 8vo, pamph., San Francisco, 1859. Bouton's Commemorative Discourse, Fiftieth Anniversary of New Hampshire General Association, Aug. 28, 1859, 8vo, pamph., Concord, 1859. Williams' "God timing all National Changes in the interests of his Christ," 8vo, pamph., New York, 1862. 8 Miscellaneous Pamphlets.

VERRILL, A. E., Yale College, New Haven. Second Annual Report of Sheffield Scientific School of Yale College, 8vo, pamph., New Haven, 1867.

WATERS, JOSEPH L., Chicago, Ill. Guide to Illinois Central Railroad Lands, 8vo, pamph., Chicago, 1867. Statistics Illinois Fruit Region, 8vo, pamph., Chicago, 1867.

WHITMORE, WILLIAM H., Boston. Notes on Peter Pelham, 8vo, pamph., Cambridge, 1867.

WORTHEN, A. H., Springfield, Ill. Norwood's Report on Illinois Coals, 8vo, pamph., Chicago, 1858. Geological Survey of Illinois, 2 vols. 4to, Springfield, 1866.

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AMERICAN ANTIQUARIAN SOCIETY. Proceedings, April, 1867.

AMERICAN BUREAU OF MINES. Memoirs of, Vol. I, No. 1, New York.

AMERICAN ENTOMOLOGICAL SOCIETY. The Practical Entomologist for June, July, August, and September, 1867. Transactions, Vol. I, No. 1.

AMERICAN PHILOSOPHICAL SOCIETY. Proceedings, Vol. X, No. 77, Philadelphia, 1867.

BOSTON SOCIETY OF NATURAL HISTORY. Proceedings, Vol. XI, sigs: 6, 7, 8, 9, 10, 11, 12, 13. Memoirs, Vol. I, pt. 2, Boston, 1867.

BOSTON MERCANTILE LIBRARY ASSOCIATION. Forty-seventh Annual Report, 8vo, pamph., Boston, 1867.

BOWDOIN COLLEGE. Catalogus Coll. Bowdoin, 1867, 8vo, pamphlet. Programme of Commencement, etc., 1867, 5 pamphlets. Catalogus Coll. Bowdoinensis, 8vo, pamph., Brunswick, 1867.

CHICAGO HISTORICAL SOCIETY. Eleventh Annual Report of Chica-

go Reform School, 8vo, pamph., Chicago, 1867. The Labor Question, Extracts, Magazine Articles bearing on the subject of Labor, 8vo, pamph., Chicago, 1867. Ninth Annual Statement of the Trade and Commerce of Chicago, 8vo, pamph., Chicago, 1867.

CINCINNATI MERCANTILE LIBRARY ASSOCIATION. Thirty-second Annual Report for 1866, 8vo, pamph., Cincinnati, 1867.

EDITORS. American Journal of Conchology. American Journal of Science and Arts, July, September. American Mining Index, July, August, September. Christian World, July, August, September. Essex Banner, July, August, September. Gardener's Monthly, July, August, September. Gloucester Telegraph, July, August, September. Haverhill Gazette, July, August, September. Kansas Farmer, July, August, September. Lawrence American, July, August, September. Lynn Reporter, July, August, September. Printer's Bulletin, July, August, September. Public Spirit, July, August, September. South Danvers Wizard, July, August, September. Trübner's American and Oriental Literary Record, July, August, September.

IOWA HISTORICAL SOCIETY. The Annals of Iowa, July, 1867, 8vo, pamphlet.

LONG ISLAND HISTORIC SOCIETY. The Carver Centenary, May 1, 1867, 8vo, pamphlet.

MUSEUM OF COMPARATIVE ZOÖLOGY, Cambridge. Annual Report, 1866, 8vo, pamph., Boston, 1867.

NEW ENGLAND HISTORIC-GENEALOGICAL SOCIETY. New England Historic-Generalogical Register, July, 1867, 8vo, pamphlet.

PHILADELPHIA ACADEMY OF NATURAL SCIENCES. Proceedings for April and May, 1867, 8vo, pamphlet.

YALE COLLEGE, CORPORATION OF. Obituary Record of Graduates, July 17, 1867, 8vo, pamphlet.

FRIDAY, OCTOBER 4, 1867. Field Meeting at Ipswich.

The last of the series of Field Meetings for the year 1867 was held this day. There was a very good attendance considering the lateness of the season. The various factories in the town were visited, while portions of the party ascended the hill, which was formerly a favorite resort of the late William Oakes, the distinguished botanist, who for many years resided in this town; others, who were interested in botany and land snails, took the Topsfield road; a few went to "The Neck," where some ancient shell-heaps were inspected.

At half past one all the parties returned from their jaunts, and gathered with their treasures in the Town Hall, where the table was spread; and, as the fresh air and brisk exercise had sharpened appe-

tites, ample justice was done to the collation. At half past two an adjournment was had to the vestry of the Methodist Church, where a large number of citizens, and young ladies from the seminary, joined the audience. The meeting was called to order by

Vice President A. C. GOODELL, Jr.,

who explained the objects of the society and briefly recounted its history. Alluding to the present meeting, he said it was the first held in Ipswich for many years, though there were many objects of interest in the town relating to several of the subjects to which the Essex Institute devoted itself.

F. W. PUTNAM was elected Secretary *pro tem.*, and announced the donations and correspondence.

The chair called upon the Rev. George D. Wildes, of Salem, to make some remarks upon the history of the town.

Mr. WILDES, after a facetious allusion to the manner in which his historical speech at Kittery had been shortened, remarked upon the antiquity of this town of Ipswich. Its very appearance, he said, stamps both its age and its origin. In all the country he had never seen any village which so much resembles an English country town. Its long wide English street, which probably had its terminus at the church, the style of the houses, and everything that is old, convey the impression of a genuine English hamlet. The names, too, suggest the same thing. Besides that of the town, which is simply borrowed from the English, there is "Pudding street," as it used to be called. He protested against the notion that this had a gastronomical origin, and suggested that it was once "Put in" street, and invited strangers to *put in* there, or come in. But even if this theory be rejected, we can remember that one of the prominent streets in London is called "Pudding Lane." He advised the people of the town, if they had not already repudiated the name, to hold on to it.

On this hill where the Congregational church stands, and on the same spot, the old church was erected at the very beginning of the town's history. He remembered as a little boy attending the bicentennial celebration of the settlement of the town, when Choate, a native of the town, was orator. This carries us back almost to the time of the first English settlement in New England. Plymouth was reached in 1620, Salem in 1626, and Ipswich in 1633. In 1634 the grant of land was made. Three years later the accommodations were so limited that a part of the town was set off and became Rowley. The speaker alluded to the curious fact that towns in New England bear sometimes a marked resemblance to those for which they are named in England. He could not say how it is in the case of Ipswich, but Bos-

ton in England and the Boston of Massachusetts twenty years ago, especially School street, had some striking points of resemblance, in the signs, the crooks in the streets, and even in the names of the inhabitants.

After giving some examples of extreme ignorance of local history by people generally, and urging increased attention to it, he inquired how many were acquainted with names that had and should make Ipswich famous. No town of its size in the country has sent out more men who have distinguished themselves in the various walks of life. You have only to go two miles across the orchards to find the house where Nathan Dane was born. A little way off in Hamilton, but once part of Ipswich, stands the parsonage of Rev. Manasseh Cutler, eminent as a clergyman, as a naturalist, and in civil and political life. The names are numerous, and time fails to go through the list.

Rev. Mr. CALTHROP being called upon gave some interesting reminiscences of old Boston, from which his family sprung, and near which he was born. He claimed to be a son of old Boston, and in accordance with the vote of Massachusetts, he should claim to be entertained at the public expense, some Fourth of July perhaps. He alluded to the origin of the name Boston, saying it is a contraction of St. Botolph's town, being named from the famous town of St. Botolph's Church, which, in some respects, is unequalled in the world. Apropos of the Puritans, who had been eulogized by Mr. Wildes, he said that the Puritans had disfigured the walls of the church with "yellow white wash," and they had been restored, partly by funds collected in this State.

Rev. Mr. WASSALL, of Newburyport, continued in the same strain. The first remembrance he had of old Boston was, that, when he visited it, the mother was just imitating the child in having a baby show. Mr. Wassall, who is much interested in natural history, especially in entomology, spoke upon the differences in the Insects of England and New England. Many species are the same. Some forms are plenty in the one and rare in the other. He gave some very amusing instances of ignorance of the structure and habits of insects.

Mr. WILLIAM P. UPHAM, of Salem, presented, in behalf of Mr. Charles W. Palfrey, an autograph letter of Nathan Dane, bearing date 1793. He alluded briefly to the fact that to him more than to any other man, are due the efforts to free the country from slavery. He drew the famous ordinance of 1787, and it was passed as written by him. The results of that ordinance can now be realized.

At the call of the chairman, Mr. GEORGE D. PHIPPEN, of Salem, explained briefly but clearly the characteristics of the flora brought in. A Gentian was noticed as being less characteristic than any other

flower of the season in which it is found. It reminds one of the early summer flowers. A New England Aster, which grows in little bunches as a wild flower, he had cultivated and obtained a composite flower the size of an old fashioned parasol. A branch of Winter-berry, he said, bore the nearest resemblance to the English holly of any plant that grows in this climate. The above are only examples of the manner in which a large number of specimens were treated.

Mr. E. S. MORSE, who was one of the party that visited the "neck" and examined the ancient shell-heaps found there, gave an account of the results of the morning's exploration. Only one shell-heap was dug into. It was composed principally of the common Clam, though a few Oysters, Quahogs, and Mussels, were found scattered in the heap. The Clam-shells were noticed to be much thicker than those found at present on the flats from which these ancient ones were probably collected. Bones of the deer, dog, beaver, cod, and of birds, were also found. Those of the deer being the most abundant of the Mammalian bones. Two pointed implements of bone were also discovered, and one or two fragments of pottery. Mr. Morse alluded to the exploration of the shell-heaps on Goose Island in Casco Bay, where quite a similar condition of things existed, and in which the bones of the Great Auk, a bird now extinct, except in extreme northern localities, were found in considerable numbers. In both localities distinct evidence of fire-places were shown by the charcoal found in the heaps, showing that the food was probably cooked on the spot.* Mr. Morse then made some entertaining remarks upon the manner in which certain of the lower animals eat, illustrating the process on the blackboard.

Voted,—That the thanks of the Essex Institute are hereby tendered to Abram D. Waite, Stephen Baker, Wesley K. Bell, Frederic Wilcomb, N. A. Dickinson, Rev. L. Dodge, and others, for their services and attentions during the day; to the Selectmen of the town for the use of the Town Hall, and to the Methodist Episcopal Society for the use of their vestry to hold this meeting.

MONDAY, OCTOBER 7, 1867. Regular Meeting.

Hon. J. G. WATERS in the chair.

Sir William E. Logan, of Montreal, was elected a Corresponding Member.

John Henry Silsbee, of Salem; J. C. Fletcher, Joseph Wassall, of Newburyport; C. W. Rose, of Marblehead; John P. Cowles, Abram D. Waite, of Ipswich, were elected Resident Members.

*For an account of a more extensive exploration of the Shell-heaps in Ipswich, and also of those of other localities, see the article by Prof. Wyman in the *American Naturalist*, Vol. 1. p. 561, Jan. 1868.

SATURDAY, NOVEMBER 2, 1867. Special Meeting.

Vice President GOODELL in the chair.

This meeting was called to take suitable notice of the decease of the President, FRANCIS PEABODY, which occurred at his residence in Salem, on Thursday evening, after an illness of several months. The chair having made a very appropriate allusion to the occasion of calling this meeting together, proposed that a committee of three be appointed to prepare a series of resolutions to report at this meeting; and Messrs. H. Wheatland, J. G. Waters, and H. F. King were appointed on said committee.

Dr. Wheatland, of the committee, reported the following resolutions, which, after remarks from Messrs. J. G. Waters, T. M. Stimpson, F. W. Putnam, the chair, and others, were unanimously adopted:

Resolved,—That the Essex Institute receives the tidings of the decease of its President, FRANCIS PEABODY, Esquire, with profound sorrow; that in his death it recognizes the loss, not only of its most devoted, laborious, and enthusiastic chief officer, but of a friend and patron of science and the useful arts, who, while distinguished for his accomplishments in a wide field of intellectual inquiry, was indefatigable in reducing the results of his investigations to practical use; a citizen who used his liberal means to advance the welfare of his neighbors by the encouragement of industry and the discovery of new sources of profit; a man whose life was characterized by untiring devotion to those studies and pursuits which lead to the highest and most enduring prosperity of any community, and, in its more intimate and private relations, was pure and blameless.

Resolved,—That, as a mark of respect to the memory of the deceased, the Rooms of the Institute be closed to the public on Monday, Nov. 4, and that the members assemble at this place on that day, at 12.30 P. M., to attend the funeral of their late President.

Resolved,—That the Hon. C. W. Upham be invited to prepare a Eulogy upon the life and character of the deceased, to be read before the members of the Institute at such time as shall be hereafter determined upon; and that the Trustees of the Peabody Fund be invited to participate in the exercises of that occasion.

Resolved,—That a copy of these Resolutions be presented to the family of the deceased, to whom the Institute hereby tenders its sincerest sympathy and condolence; and that a copy be also forwarded to George Peabody, Esquire, of London, who so much relied upon the deceased for the wise management of his large donation for the promotion of science and useful knowledge in the County of Essex, between whom and the deceased the warmest feelings of kindred and friendship existed.

WEDNESDAY, NOVEMBER 13, 1867. Quarterly Meeting.

JAMES KIMBALL in the chair.

Committees were appointed for holding meetings on each Monday evening during the ensuing winter; also such microscopic meetings as may be deemed expedient.

Frank W. Miller, of Portsmouth, N. H., was elected a Corresponding Member.

W. W. Richards, of Salem, was elected a Resident Member.

MONDAY, NOVEMBER 18, 1867. Regular Meeting.

Vice President GOODELL in the chair.

Letters were announced from,—Massachusetts Historical Society, Boston (Aug. 7); E. Hall, Athens, Ill.; Prof. H. C. Wood, jr., Philadelphia; R. S. Rantoul, Salem (Aug. 23); S. Jillson, Hudson; C. J. Maynard, Newtonville (Aug. 25); E. N. Walton, Salem (Aug. 26); Hon. Ezra Cornell, Ithaca, N. Y.; Henry Saltonstall, Boston; B. W. McLain, Root, Ind. (Aug. 28); D. Appleton & Co., New York; Prof. J. Wyman, Cambridge; John C. Gray, Boston; E. N. Walton, Salem (Aug. 29); Rev. James Hubbert, Kingston, C. W. (Aug. 30); Dr. Wm. Stimpson, Sec. Chicago Acad. of Sciences; I. P. Langworthy, Boston (Aug. 31); Museum of Antiquaries of Scotland, Edinburgh (Sept. 1); D. Appleton & Co., N. Y. (Sept. 4); Literary and Philosophical Society of Manchester, Manchester; S. H. Scudder, Sec. Boston Society Natural History; Richard Eddy, Libr. Historical Society of Pennsylvania (Sept. 5); C. C. Beaman, Cambridge (Sept. 9); Rev. James Hubbert, Montreal; Prof. L. W. Bailey, University of New Brunswick, Fredericton, N. B. (Sept. 10); Royal Institution of London (Sept. 11); D. Appleton & Co., New York; W. G. Binney, Burlington, N. J.; S. Jillson, Hudson; A. Hyatt, Keesville, N. Y.; S. R. Carter, Paris Hill, Me.; I. P. Langworthy, Boston (Sept. 13); T. S. Peace, Manchester, England (Sept. 16); Leeds Philosophical and Literary Society, Leeds; Prof. A. E. Verrill, Yale College; I. P. Langworthy, Boston; G. W. Pease, Salem (Sept. 17); P. R. Uhler, Baltimore (Sept. 18); Dr. Elliott Coues, U. S. A., Columbia, S. C.; Prof. Richard Owen, New Harmony, Ind.; Dr. H. C. Wood, jr., Philadelphia (Sept. 19); Moses W. Putnam, Haverhill (Sept. 20); Prof. A. E. Verrill, Yale College (Sept. 22); S. P. Fowler, Danvers; Joseph Banvard, Paterson, N. J. (Sept. 27); S. R. Carter, Paris Hill, Me.; Prof. A. E. Verrill, Yale College; Curator of the Indian Museum, Calcutta; E. O. Hovey, Crawfordsville, Ind. (Sept. 28); Charles A. Houghton, Holliston; H. F. Bassett, Waterbury, Ct. (Sept. 30); J. K. Wiggin, Boston (Oct. 1); Prof. L. W. Bailey, University of New Brunswick; Dr. C. C. Abbott, Trenton, N. J. (Oct. 2); P. A. McMoore, Fort Ann, N. Y.; N. E. Atwood, Provincetown (Oct. 3); Otis Fuller, Boston; A. B. Garber, Easton, Pa.; G. D. Smith, Boston; Thomas A. Dickinson, Lewiston,

Me.; Prof. S. Tenney, Poughkeepsie, N. Y.; Moses W. Putnam, Haverhill (Oct. 5); A. H. Curtiss, Liberty, Va.; Prof. J. Lovering, Cambridge; G. D. Phippen, Salem (Oct. 7); Prof. W. B. Rogers, Lunenburg, Mass. (Oct. 8); John H. Silsbee, Salem (Oct. 9); J. P. Cowles, Ipswich (Oct. 10); Lyceum of Natural History, New York; A. Hyatt, Watertown, N. Y. (Oct. 11); W. E. Merriman, President Ripon College, Ripon, Wis.; A. H. Curtiss, Liberty, Va. (Oct. 12); Dr. C. C. Abbott, Trenton, N. J. (Oct. 13); Rev. E. C. Bolles, Portland, Me.; Geo. A. Pope, Baltimore, Md. (Oct. 14); G. W. Smith, Grand Rapids, Mich.; Charles Reed, Librarian Vt. State Library, Montpelier, Vt. (Oct. 15); Dr. B. Pickman, Boston; J. Wassall, Newburyport (Oct. 17); R. Brookhouse, Salem (Oct. 18); Dr. J. B. Holder, U. S. A., Fort Monroe, Va.; A. Hyatt, Rochester N. Y.; Prof. L. W. Bailey, Fredericton, N. B.; Chicago Historical Society, Chicago, Ill.; George A. Pope, Baltimore, Md. (Oct. 19); Prof. Richard Owen, Bloomington, Ind.; Samuel L. Ward, Philadelphia, Pa.; Massachusetts Institute of Technology, Boston; Surgeon-General's Office, Washington, D. C. (Oct. 21); S. Jillson, Hudson; H. F. Bassett, Waterbury, Ct.; R. M. Chipman, East Granby, Ct.; S. L. Boardman, Augusta, Me.; A. Hyatt, Ithaca, N. Y. (Oct. 24); W. S. Clark, President Mass. Agricultural College; C. C. Hitchcock, Ware; Henry O'Reilly, New York (Oct. 26); Joseph Banvard, Paterson, N. J. (Oct. 28); Naturwissenschaftlicher-Verein zu Bremen (Oct. 29); A. C. Hoyt, Boston (Oct. 30); L. W. Schmidt, New York; C. J. Maynard, Newtonville; R. H. Seeley, Haverhill (Nov. 1); E. T. Cresson, Sec. Am. Entomological Soc'y; S. H. Scudder, Sec. Boston Society Nat. Hist.; A. P. Garber, Lancaster, Pa.; Prof. A. Gray, Cambridge (Nov. 2); Trübner & Co., London; P. R. Uhler, Peabody Institute, Baltimore, Md. (Nov. 7); A. O. Dobbear, Lexington, Ky.; Cleveland Abbe, U. S. Naval Observatory (Nov. 8); W. H. Dall, St. Michaels, R. Am.; Henry Gillman, Detroit, Mich. (Nov. 11); Chas. H. Nauman, Lancaster, Pa.; Dr. H. C. Wood, jr., Philadelphia, Pa.; C. Fred. Hartt, New York; Prof. O. C. Marsh, Cazenovia, N. Y. (Nov. 12); Horace Mann, Cambridge (Nov. 14).

F. W. Putnam gave an account of the explorations of several members of the Institute to examine the Indian shell-banks at Goose Island in Casco Bay, and at Ipswich. Many relics were found of great interest to the archæologist. An appeal was made to members of the Institute and others who may discover Indian relics, such as arrow-heads, axes, gouges, etc., which are occasionally ploughed up in our fields, to forward them to the Institute. He also requested that information of the discovery of any Indian's grave be sent to the Institute, that it might be properly examined and a description of the same, with all the accompanying circumstances, be made and deposited in the archives.

Donations to the Library and Museum were announced.

William H. Little, of South Danvers, and James P. Boyce, of Lynn, were elected Resident Members.

MONDAY, NOVEMBER 25, 1867. Regular Meeting.

Vice President GOODELL in the chair.

Letters were announced from, — Smithsonian Institution, Washington, D. C. (Oct. 23); Connecticut Academy of Arts and Sciences; Trustees of the Phillips Academy, Andover (Nov. 19); Rev. James Hubbert, Montreal, Canada; C. C. Hitchcock, Ware (Nov. 21); A. P. Garber, Columbia, Pa.; Henry Davis, Decorah, Iowa (Nov. 22); Howard Challen, Philadelphia, Pa.; Massachusetts Historical Society, Boston (Nov. 23); W. W. Richards, Salem; Peabody Institute, Baltimore (Nov. 25).

Charles W. Felt presented several specimens of typography of beautiful execution, and made a few remarks thereon.

Alpheus Hyatt spoke upon the affinities of the *Beatricea*, a strange fossil from the island of Anticosti, which had a very close resemblance to a tree. But he showed, that although previously described as such by Mr. Billings, Paleontologist of the Canada Geological Survey, it was not a plant, but a molluscan shell belonging to the class Cephalopoda. It possessed the composite character of many of the most ancient fossils, and combined in its organization features which were common to several other types. Although fossil, the cast of the animal, which inhabited one end of the gigantic conical shell, often twenty-five or thirty feet long, and thirteen inches diameter, was well preserved, and the form of the arms might be traced on the core.

E. S. Morse then traced the gradual development of a head among the mollusks, and showed how it was first formed among snails, but capable of being withdrawn within the shell, then fully formed among Cephalopods, but incapable of being withdrawn, except among these lowest fossil forms, where it was probably permanently held within the shell.

A. S. Packard, jr., exhibited drawings made by Mr. J. H. Emerton of a new and very interesting *Chironomus*, the larva of which live upon the floating fragments of eel-grass in the harbor. But very few of the larvæ of Diptera are known to inhabit salt water. This larva, although so situated and exposed to frequent submergence, is provided with air-vessels, which show that it must breathe in the air and not in the water. It is very active in its habits, feeding on refuse matter, and probably on the worms which also construct their cases on the surface of the grass. The larva transforms in autumn, and appears during the month of November.

Donations to the Library and Museum were announced.

Theodore Brown, of Salem, was elected a Resident Member.

MONDAY, DECEMBER 2, 1867. Regular Meeting.

Vice President GOODELL in the chair.

Mr. A. C. Goodell, jr., read a paper on the Progress of Sacred Music in New England from its earliest settlement to the beginning of the present century.

The history of Puritan psalmody begins with the Reformation, when the great innovators of doctrines and disciplines invaded the choirs as they had the altars, and divided the services of both between the preacher and the congregation.

The reformed music, though much derided by the cathedral priests, is now universally praised by competent critics for its sublimity and peculiar fitness. A recent principal of the Royal Academy of Music has declared, in a critical review of music, that "the pure sacred strains" such as the "old Hundredth psalm," and the tunes "London," "Windsor," etc., and those made in imitation of them, "are alone worthy of study."

The work of the Reformation was greatly aided by them, and these were the tunes with which our Puritan fathers were familiar, and which they brought with them to these shores as among their most sacred treasures.

A copy of Thomas Ravenscroft's collection of tunes dated 1621, containing the autograph of Gov. Endicott, and now in the Mass. Historical Society's Library, was next described as a work showing a very thorough and correct knowledge of musical science on the part of the composers, as well as of the singers who used it; and the use of this book, several copies of which are still preserved in old libraries in New England, as well as many other facts, were adduced to show that the earliest settlers of New England were good musicians; and the Puritans of England were also shown to be proficient in music, notwithstanding the modern opinion to the contrary. But the second and third generations in New England lost much of what their fathers and grandfathers knew, including the use of instruments with which many of the first settlers were familiar, but which had become so neglected in 1673, that the Commissioners for Plantations reported that there were then "no musicians by trade" in the whole colony.

Music in the New England congregations was entirely vocal from the first. At Salem, Ainsworth's psalms were used until 1667, and in Plymouth until 1692. These were provided with tunes printed to accompany the verses, so that it was not necessary to line out the psalm in these places, as had been the custom in other places where the Bay Psalm book (without music) was used. Ainsworth's version contained forty-four tunes.

The "lining" or "deaconing off" the verse was an obvious impediment to perfect melody. And though strongly defended by many of the clergy, was probably one of the causes that led to the rise of a body of anti-psalmists between 1640-1660.

Music gradually grew worse; the number of tunes used in public worship was reduced to thirteen, and, in most congregations, no more than three or four of these were ever attempted to be sung. The hymn was lined and then sung by *rote*, as it was called, the whole congregation joining, without regard to the rules of rhythm, melody, or dynamics, and with no knowledge of, or attempts at harmony. The confusion that ensued was ludicrous in the extreme, and is described by a contemporary, the Rev. Thomas Walter, as sounding "like five hundred different tunes roared out at the same time."

The date of the arrival of the Province Charter (1692) or of the revolution of 1688 was described as an epoch in the history of music, as well as in many other things enumerated. The first music printed in New England appeared about 1690, and within about thirty years thereafter a successful attempt was simultaneously made to introduce "regular singing" or singing by *note* instead of the loose and incorrect *rote* singing which had prevailed. The action of the leaders in this movement was narrated at considerable length.

In 1710, the first mention of the use of organs in New England appears. The unpublished diary of Rev. Joseph Green of Danvers, now in the possession of a member of the Institute, contains the following entry under date of May 29, 1711: "I was at Mr. Thomas Brattle's heard ye organs and saw strange things in a microscope." And in 1713, an organ was imported for King's Chapel in Boston, which lay seven months in the porch before it was set up on account of the public clamor against it.

In 1743, the first organ was set up in Salem, in St. Peter's Church; and in 1745, Edward Bromfield, of Boston, nearly completed the first American-made organ, which was declared a very fine instrument of 1300 pipes and two banks of keys. And the first organ used outside Episcopal churches was set up in Providence, R. I., in 1770.

Competent musicians began to arrive here, and to spring up among the population, and music books and books of musical instruction were published here, — the first by Rev. John Tufts, of Newbury, in 1712.

Details of the struggle to introduce regular singing were given, and also an account of the early engravers of music.

The American Revolution was next asserted to be another epoch in more respects than one; and, as it approached, a movement led by Rev. Lemuel Hedge, of Warwick, Mass., was made to abolish the "lining out" process which had generally prevailed up to that time.

This movement was, also, successful, and was one of the results of the previous movement in favor of regular singing.

At this period, also, William Billings, of Boston, of whom an account was given, began to compose original and peculiar music, which, for a long time, enjoyed unbounded popularity. His fugues, although inferior music, were described as the work of a man of genius, and as being marks of progress from the previous condition of music here. He improved the system of singing schools started in 1720 by Rev. Thomas Symmes, of Bradford, introduced instrumental music, and created a popular enthusiasm in behalf of music generally.

Fugue music has been often described as of American origin, and has been severely criticized and derided on that account; but it was, in fact, introduced into England from Italy as early as towards the close of Elizabeth's reign. It has its uses in musical composition, and has been applied with great effect by almost all great composers. But Billings's style and his use of fugues was entirely unfitted to devotional themes.

The state of music, though improved from former times was low indeed in New England during the last thirty years of the eighteenth century. In England, it was, relatively, lower still. Since Billings's day its course, here, has been steadily upward.

From 1760 to 1780, seats began to be set apart for select choirs, and instrumental music began to be introduced. Music, after the beginning of this century, began to improve. Accounts were given of the individuals and societies prominent in this work of reform, beginning with the Essex Musical Association of 1797, and its sister society in Middlesex.

The struggle that ensued between the old-fashioned fuguists and the "Old Hundred" singers (as they were called) of the New School was depicted.

Instruments were generally introduced in the following order: first, the pitch-pipe; second, the tuning-fork, or the brass reed; and third, the violoncello, which was followed by the flute, hautboy, clarionet, bassoon, and violin; and, finally, the majestic organ, which, though introduced here before the Revolution as previously stated, was never used west of the Alleghanies until 1837.

Finally, the productions of our native composers were briefly commented on, and the fact noticed that from Salem had gone forth the beautiful and familiar tunes of "Supplication," "Merton," and "Federal street."

The paper closed with an appeal for the revival of Congregational singing, which it was declared the direction of musical progress and the present state of musical taste and education indicated, as the next great movement in this line.

Donations to the Museum and Library were announced.

George H. Vibert, of Rockport; Francis A. Langmaid, of Salem, were elected Resident Members. Henry Davis, of McGregor, Iowa, was elected a Corresponding Member.

MONDAY, DECEMBER 9, 1867. Regular Meeting.

Vice President GOODELL in the chair.

The chairman alluded to the arrangements for a meeting on every Monday night during the winter.

Letters were read from, — Prof. J. S. Newberry, Columbia College (Nov. 25); John C. Wetmore, Essex, Mass.; Howard Challen, Philadelphia; Dr. E. Diffebaugh, Philadelphia; Prof. E. D. Cope, Philadelphia (Nov. 27); Dr. A. C. Foote, University of Michigan, Ann Arbor, Mich.; A. L. Babcock, Sherborn, Mass. (Nov. 29); Dr. I. P. Trimble, State Entomologist of New Jersey, Newark, N. J.; New England Glass Co., Boston (Nov. 30); M. C. Cooke, Secretary Quekett Microscopical Club, London (Dec. 1); Dr. E. W. Hubbard, Tottenville, Staten Island; Robert Howell, Nichols, N. Y.; Samuel R. Carter, Paris Hill, Me.; Prof. Alex. Winchell, University of Michigan (Dec. 4); Prof. J. S. Newbury, Columbia College; Prof. S. Tenney, Vassar College (Dec. 5); H. Willey, New Bedford, Mass. (Dec. 6); Prof. S. F. Baird, Smithsonian Institution (Dec. 7).

Mr. Putnam read by title the following communication from Mr. H. WILLEY, of New Bedford.

AMERICAN LICHENOGRAPHY.

It is proposed in this sketch to give a brief account of such works on the subject of Lichens published in this country as have fallen under the writer's observation. The study of this branch of botany, interesting as it is, is confined to a few, who labor under great disadvantages, from the scattered nature of what has been published by our own writers, and the absence of a complete American Lichenography, brought up to the present state of knowledge, and based on the modern views of the science. Several interesting local catalogues have, however, been published, and Professor TUCKERMAN's valuable Synopsis, published in 1848, gave a full and accurate view of the Lichen flora of the northern part of the continent, so far as known at that time. But very much has been discovered since then, and the use of the microscope has imparted an entirely new aspect to the science. A fresh impulse would doubtless be given to the study, and many botanists would engage in the investigation of the Lichen flora of our country, so vast, and as yet so imperfectly explored, could they

have the assistance of such a work. The want, we hope, will not long remain unsupplied.

ACHARIUS, the father of Lichenology, as he has been styled, published numerous American Lichens in his *Lichenographia Universalis*, Göttingen, 1810; and *Synopsis Lichenum*, Lund, 1814. Swartz, in his *Lichenes Americani*, Norimberg, 1811, one number only of which was published, gave an account of twenty-five American species, mostly from the West Indies. He mentions two New England species, *Parmelia colpodes* and *P. congruens*, the latter of which, however, is unknown to our Lichenists, and the plant described is probably only a form of some other plant.

The *Flora Virginica* of GRONOVIVS, Leyden, 1739, in which the plants collected by Clayton are described, mentions a few Lichens. But to come to American publications.

The *Index Floræ Lancastriensis*, by MUHLENBURG, Vol. III. of the Transactions of the American Philosophical Society, Philadelphia, 1793, contains a list of thirty Lichens, concluding with the remark, "*et alii multi novi*." All these were probably included in his *Catalogus Plantarum Americæ Septentrionalis*, Philadelphia, 1818. He gives the name of 184 species, arranged according to the Acharian System, eighteen of which are noted as new. There are no descriptions of the plants, but according to Professor Tuckerman in the Boston Journal of Natural History, they are described in the sixth edition of Eaton's Manual, 1833, a work which the present writer has not seen.

Professor TORREY, in his *Catalogue of Plants growing spontaneously within Thirty Miles of the City of New York*, Albany, 1819, enumerates sixty species of Lichens, and gives their stations. There are no new species in his list.

In the *American Journal of Science*, Vol. VI, p. 105, Professor TORREY describes, under the name of *Usnea fasciata*, the plant called in Tuckerman's Synopsis, *U. sphacelata* R. Br., and since, *U. aurantiacolatra* Jacq.

The next publication is HALSEY'S *Synopsis of the Lichens near New York*, published in 1823 in Vol. I. of the Annals of the Lyceum of Natural History. This is a valuable catalogue, enumerating 176 species, with their stations, and giving brief descriptions, with colored figures of four species. Nine are new, of which descriptions are furnished by Schweinitz. Halsey alludes to a promised work on Lichens by Schweinitz, but this was never given to the public.

The *Catalogue of Animals and Plants of Massachusetts*, in Professor HITCHCOCK'S Report on the Geology, Botany, and Zoölogy of that State, was published separately at Amherst in 1835. It gives 116 Lichens as occurring in Massachusetts.

IN NUTTALL'S Catalogue of Plants collected on the Pacific Coast by Wyeth, in the Journal of the Philadelphia Academy, Vol. VII, a new lichen is described under the name of *Borrera Columbiana*, which he remarks resembles *Lichen vulpinus* Linn., found on the Columbia River. It is also noticed in Tuckerman's Enumeration, 1845 (under *Parmelia*), but not since.

HOOKE'S *Flora Boreali-Americana*, London, 1840, though not published in this country, may be mentioned here, as giving, according to Professor Tuckerman, "besides a general survey of the Lichens of that region, and descriptions of new species, many remarks illustrative of the economy and the uses of these plants. . . . The part which includes the Lichens is as valuable to the student of these plants in this country as in England."

We come now to the writings of the distinguished botanist, who has done more than any other in this country to advance the knowledge of our Lichens, and from whom we have still much to expect, Professor EDWARD TUCKERMAN, of Amherst. In 1835, he read before the Boston Society of Natural History, *An Enumeration of some Lichens of North America*, published in Vol. II. of its Proceedings. Three further enumerations were published in Vols. III. and V. of the same work, from 1843 to 1847. In the last, the whole number of known North American Lichens is stated to be 165. These papers derive great interest from the fact that they contain the first special notices of the alpine Lichen Flora of the mountains of Vermont and New Hampshire. In the last he remarks that "127 species and four permanent varieties have been enumerated, and their stations given; of which fifty were not previously included in the United States Flora." He proceeds to give an account of the systematic arrangement of the Lichens up to that period, as developed in the writings of Linnæus, Acharius, Fries, and others, mentioning also the catalogues of Muhlenburg, Torrey, Halsey, and Hitchcock, above noticed, and concludes with some remarks on the uses of Lichens. Professor Tuckerman's remarks on the various plants he notices are full of interest, and marked by that caution and discrimination which characterize the accurate observer and the philosophical mind, and which he has so ably manifested in his later and more difficult and profound studies.

In *Observations on some interesting Plants of New England*, published in the American Journal of Science, in 1843, Professor TUCKERMAN mentions two Lichens, *Cetraria Tuckermanii* (which, however, has not held its place as a distinct species), and *Solorina saccata*. This last has not been published as occurring in New England, but the present writer has found it in Pittsfield.

In 1845, appeared *An Enumeration of North American Lichens*, by Professor TUCKERMAN, published at Cambridge. This little work con-

tains an Essay on the Natural Systems of Oken, Fries, and Endlicher, followed by a Preliminary View of the Structure and General History of Lichens, and an Enumeration of North American Lichens, arranged according to the Friesian system, giving the generic characters, but no descriptions of the species. The list contains 238 species, but the author remarks that it is incomplete.

His valuable *Synopsis of the Lichens of New England, the other Northern States, and British America*, was published at Cambridge in 1848. It was and remains as yet the only full enumeration, with descriptions, of North American Lichens, but is partially supplemented in writings subsequently to be noticed. Its great value lies in the excellent descriptions from Fries, on whose system it is based, and to the general principles of which the author still adheres. It enumerates and describes 295 species, of which about twenty are here first described.

LEA's *Catalogue of the Plants of Cincinnati*, Philadelphia, 1849, gives a list of fifty-three species of Lichens, arranged by Professor Tuckerman. AGASSIZ's *Lake Superior*, published in 1850, contains a *List of Lichens* collected in that region, including seventy-one species, also arranged by Professor Tuckerman.

The American Journal of Science for 1858 and 1859, contains two *Supplements to the Enumeration of North American Lichens*, of the same author. Sixty-six species, mostly new, from the Pacific coast, Cuba, the Southern States, and New England, are mentioned and described. In the latter of these the spore-character is for the first time noticed. In 1860, he contributed to the Proceedings of the American Academy of Science and Arts (Boston), Vol. V, *Observations on North American and other Lichens*, giving a review of the genera *Physcia* and *Pyxine*. These observations were continued in Vols. V. and VI. of the same work, published in 1862 and 1864. In them the author shows that he had fully kept pace with the advance of the science, which by the application of the microscope to the study of the internal structure, and the development of the spores of Lichens, had assumed an entirely new aspect since the era of the older Lichenists, who studied and wrote without the aid of that instrument, now indispensable to all who would make any certain progress in Lichenology, and which, while it opens new difficulties, adds greatly to the fascinating interest of the study. The last two of these papers are mostly occupied with descriptions of the Lichens collected in Cuba by Mr. Wright, though quite a number of New England and other continental plants are mentioned and described for the first time.

Professor TUCKERMAN also described the Lichens brought home by the Wilkes Exploring Expedition, published in 1861, and accompanied by admirable drawings of new species. The number of species mentioned is 104, of which four are new.

The next work of this author is *The Lichens of California, Oregon, and the Rocky Mountains, so far as yet known*. Amherst, 1866. The object of this work is, in the words of the author, "to show at the beginning of careful exploration, exactly what is known of the Lichen Flora of the west coast south of Vancouver's Island, and of the great western system of mountains within the same range of latitude." He also alludes briefly to his present views of system, which will be more fully developed in a work on *The Genera of North American Lichens*, in course of preparation, the appearance of which, we trust, will not long be deferred. This catalogue enumerates 184 species, of which about eighteen are new. An appendix gives descriptions of nine other new species, four of which are from New England.

Following this is *The Lichens of the Hawaiian Islands*, in the Proceedings of the American Academy of Science and Arts, 1867, comprising the Lichens collected by Mr. Mann, together with those previously known. It contains 130 species, of which seven are new.

The Geological and Natural History Survey of North Carolina, Part III, Botany, by Rev. M. A. CURTIS, D. D., Raleigh, 1867, contains a list of 217 lichens of that State, with brief indications of their stations. A note from the author says: "The list was arranged by Professor Tuckerman some seven or eight years ago. His present views are different." Professor Tuckerman desires it to be understood that he declines to acknowledge it, being made up of an old list, with changes and additions which he was not permitted to see.

In a paper in the *American Naturalist* for April, 1868, Professor TUCKERMAN discusses the question, Can Lichens be identified by chemical tests? and expresses himself inclined to the negative opinion.

To complete the record of Professor TUCKERMAN's labors, we have to mention *Lichenes Americæ Septentrionalis exsiccati*, Cambridge, 1847-1855, a valuable collection of specimens of about 150 species of North American Lichens, and *Caroli Wright Lichenes Insulæ Cubæ curante E. Tuckerman*, Boston, 1864, a collection of the Lichens of Cuba, which, as we have above mentioned, are described in the *Observations*.

OLNEY's *Catalogue of Rhode Island Plants*, published in Vol. I. of the Proceedings of the Providence Franklin Society, Providence, 1846, contains a short and incomplete list of Lichens, comprising twenty-four species. Among them are *Calicium tympanellum* Ach., and *Borreria ciliaris* Ach.; but it is doubtful whether the plants thus named were genuine specimens.

DARLINGTON's *Flora Cestrica*, third edition, Philadelphia, 1853, contains a list of Lichens of Chester county, arranged by Dr. Michener, with descriptions condensed from Tuckerman's Synopsis. It enumerates 105 species, of which the author says: "About twenty were never

before published in this country, one half of which are entirely new."

The *Journal of the Essex Co. Natural History Society*, Vol. I, No. 2, 1839, at page 96, contains a notice of *Cladonia uncialis*, var. *reticulata* (the *C. Boryi* of Tuckerman's Synopsis), by JOHN L. RUSSELL, with notices of six other New England Lichens. The same plant is farther noticed in No. 3 of the same Journal, at page 125, together with *C. gracilis*, var. *elongata*.

In the *Proceedings of the Essex Institute* are the following notices of Lichens, all by Mr. Russell:

Vol. I, p. 15, mention of some lichens occurring in Brattleborough and on Mansfield Mountain, Vt. Among them are *Parmelia ostreata* Fr., *Coniocybe furfuracea* Ach., and *C. pallida* Fr., not previously noticed as occurring in this country.

Vol. I, p. 188, description of the new genus and its as yet solitary species *Hydrothyria venosa* Russ., *Verrucaria maura* Wahl., *Sphaeromphale atra* Russ., and *Verrucaria perpusilla* Russ. These last two Mr. R. now considers as doubtful.

Vol. II, p. 35, mention is incidentally made of the occurrence of *Parmelia* [*Pannaria*] *brunnea* Sw., first found in this country by Mr. Oakes.

Vol. II, p. 184, *Some Notes on the Cryptogamic Vegetation of the Azores*, contains notices of forty-five species of Lichens, collected by Thomas W. Higginson.

The *New American Cyclopædia*, Vol. X, contains a good general article on Lichens, also by Mr. RUSSELL.

A note in the *American Naturalist* for October, 1867, by the present writer, mentions the occurrence of *Biatora lucida* Fr. in the White Mountains (Berlin Falls). But *Verrucaria margacea* Wahl., is there erroneously mentioned as having occurred to him in Vermont.

The *Annals of the Botanical Society of Canada*, contain the following notices of Lichens:

Vol. I, p. 49, abstract of a paper entitled, *What to Observe in Canadian Lichens*, by W. LAUDER LINDSAY, read Feb. 15, 1851.

Vol. I, p. 78, *A List of Plants collected on the South and East Shores of Lake Superior, and on the North Shore of Lake Huron in 1860*, by ROBERT BELL, mentions seven lichens, all common.

Vol. I, p. 81, a paper on *The Economical Uses of Sticta pulmonaria*, by N. T. DRUMMOND.

A Provisional Catalogue of Canadian Cryptogams, by DAVID A. P. WATT, published in Vol. II, No. 5, of *The Canadian Naturalist*, October, 1865, enumerates 156 species of Lichens, arranged after the Acharian system, but without indication of stations or localities.

A communication from Dr. H. C. Wood, jr., of Philadelphia, *On the Phalangeæ of North America*, was also read by title and referred to the Publication Committee.

Dr. A. S. Packard, jr., read an extract from a letter from Mr. E. T. Cox, of New Harmony, Ind., relative to the habits of the "Buffalo Gnat," a species of *Stimulium*, two or three times the size of the "Black Fly." (Dr. Packard's paper will be published in full in the next Volume.)

Mr. F. W. Putnam exhibited a series of Indian Implements, made of stone, which had been found in various parts of Essex county; quite a number of them having been recently presented. He called attention to the different kinds of stone "axes," "tomahawks," "gouges," "arrow-heads," and other implements to which he could give no accurate name. Some of them he called "sinkers," from the fact that they seemed well adapted for sinking a fish net or line, and also from many of them having been found on the shore at Swampscott and other places. These stones are generally pear-shaped, but one of them, found in Essex and presented by John Choate, Esq., of Essex, was of a very singular form, more nearly resembling a "humming top" in its shape than anything else with which he could compare it. Other stones have often been found, the use of which has not yet been ascertained. Some of these are of a flattened oval form, and others are nearly round, but all have a groove cut round them. He also called attention to the flat smooth stones with two holes bored through them, and which he believed might have been used in twisting strips of skin or bark together to form a rope. Another form to which he alluded, was that of stones of perfect finish and of various shapes, but all provided with a hole through their thickest portion, in blowing into which (as one does into a key) a loud call or whistle could be sounded.

Among the "Arrow or Lance-heads" exhibited, was one of very fine workmanship, 4.2 inches long, and 0.8 of an inch in width at its base, which was unlike any he had before seen from this part of the country. This specimen was quite recently found on the farm of Winthrop L. Dodge, Esq., at Hamilton, and presented by Mr. Dodge to the Institute.

A very fine and quite large Stone Axe was shown, which was found at Danvers by John Bates, Esq., and by him presented to the Society.

Among the implements recently received were the following:

A fine Stone Gouge, from Topsfield, presented by Jacob Kinsman, Esq.

A large Stone Axe, eight inches in length, by 4.5 inches in width; a smaller Axe five inches in length, by 4.5 inches in width, from Essex, presented by Robert Burnham, Esq.

The singular "Humming-top" shaped implement, from Essex, presented by John Choate, Esq.

A flint Arrow-head, three inches in length, from Essex, presented by Ebenezer Stanwood, Esq.

An Arrow-head, 2.5 inches in length, from Middleton, presented by Wm. A. Phelps, Esq.

An Arrow-head from Middleton, presented by Mr. Charles Phelps.

A Lance-head, and one of the flat oval Stones, with the groove around it, as mentioned above, from Essex, presented by Erbridge Perkins, Esq.

Several peculiar Stones, supposed to have been shaped by the Indians, were presented by Eben Perkins, Esq., of Essex, who found them on his farm.

Mr. Putnam also exhibited to the meeting portions of two skeletons of Indians recently received. One of them was quite perfect and the skull was in very good condition and nearly whole. This skeleton was lately found on the land of Jesse Peabody, Esq., of Middleton, and was secured for the Institute collection through the kind services of William A. Phelps, Esq., of Middleton.

The other skeleton, which was more decayed and of which only a portion could be saved, was kindly presented by John C. Wetmore, Esq., of Essex, who, upon discovering it, notified the Institute of the fact, and allowed it to remain undisturbed until it could be sent for. This skeleton was one of six found near together on Mr. Wetmore's farm.

The following is the account furnished by Mr. C. Cooke, who was despatched to make the necessary observations and carefully pack the bones, as was also the case in regard to the Middleton skeleton:

"The Essex skeletons were found from eighteen to twenty-four inches below the surface, lying in a row running north and south, and were six in number, with a distance between them of about five feet, with the exception of the fifth and sixth, which were only about eighteen inches apart.

"The bones of the fifth skeleton, although those of an adult of large size, were much slighter than the others, especially the sixth, by the side of which it was found. It may perhaps be that of a female.

"Beneath this skeleton were found three flat, irregular pieces of red sandstone (a rock not found in this region), one piece placed under the head, another under the middle of the body, and the third about under the feet; showing more care taken in the interment of this body than of the others. No traces of implements or remains of pottery were found with any of them. All the skeletons were found in the same position, namely, lying faces to the west, on the left side, with hands under the head, and the knees drawn up against the chest. They were in a very decayed condition; the one brought home being the best of the lot. The place where they were

found is a slight slope, and has been planted for a number of years, which would perhaps account for their being so near the surface,—the top soil having been gradually removed.”

Mr. Cooke had also called Mr. Putnam's notice to the fact, that, of the eleven Indian graves found in Essex Co. and examined either by Mr. Cooke or himself, within the last two years, only two of them were found to contain implements of any kind. One of these, however, that found on Winter Island was remarkably rich in stone implements, and the other found in Lagrange street, contained the singular “bone spoons” and bone ornaments, of which a description will be given at a future meeting.

Mr. Putnam also exhibited several pieces of Indian Pottery from Lake Harney, Florida, presented by Miss M. G. Wheatland; and a fragment of red Pottery from one of the “mounds” near Springfield, Ohio, presented by Mr. Albert S. Kingsman, of Salem.

He said that he had taken this occasion to speak of the various Indian remains and relics at some length, as he wished to secure the cooperation of members in interesting persons throughout the county, and especially farmers, in the collection of the relics of our Aborigines, that as complete a record as possible may be made of them. He stated the necessity of obtaining a large number of each kind of implement, in order that through a study of them some common characters might be found which would enable archæologists to associate the former inhabitants of our region, with those of other places, and thus aid in throwing light on one of the great questions of the day,—“The Origin and Migrations of the Human Race.”

He hoped that farmers and others throughout the county and its vicinity would search for all Indian relics, lying forgotten in their houses and barns, and send them to the Institute, where they would be classified and arranged, and aid in solving the most interesting questions relating to the history and migrations of the early races of men on our continent. He hoped that in the spring farmers would carefully examine their grounds for all relics of the past.

If all the persons in Essex county would send every Indian relic they have, or may find, to the Institute, it would form an unrivalled local archæological collection. Will not our friends unite in bringing about this desired end?

Mr. Putnam also exhibited the other donations to the Scientific Department, received since last reported.

Dr. Packard spoke of the rude way in which the Esquimaux in Labrador buried their dead. He had found at Hopedale two skeletons, male and female, laid in a fissure in a rock, on the side of a high hill. The site of the grave was marked by an upright pole. The remains were simply covered by stones laid over the top of the fissure, which

was just wide enough to admit the bodies. There was no soil to cover them with. It was his impression that their heads pointed to the south-west, the feet being directed towards the north-east, following the course of the fissure. No implements or garments accompanied the bones, which probably were sepulchred before the advent of the Moravian missionaries, and perhaps over a century since.

The lower jaws were large and stout, and the teeth "double" all around, *i. e.* the corners of those of the upper and lower jaws were worn off square and did not overlap.

In the rather large lower jaw he was reminded of the figure of the "fossil jaw" of "prehistoric man," and the speaker alluded to the famous controversy between the French and English savans, regarding the human jaw (lower maxillary), discovered by a quarry-man working in the gravel-pit at Moulin Quignon, France, and brought to the notice of M. Boucher de Perthes, "the pioneer and representative of modern archaeology," who "withdrew from the ground with his own hands the entire half of a human jaw, having the second molar in position." "Near the jaw were found a hatchet, two other teeth, and a portion of a fourth," and afterwards the teeth of the mammoth were picked up in a bed overlying that containing the jaw. It was concluded that the possessor lived in the "stone age," and was coeval with the mammoth.

Drs. Falconer and Bush, of London, disputed the alleged antiquity of the bone. The majority, however, allege that the jaw, from its anomalous shape, belonged to a man of a different race from ours. Many archaeologists refer all the bones and implements of the stone age to a very degraded race, lower than any savage tribes known to exist in Europe or Asia; others refer them to races like the Esquimaux, and assume that the Esquimaux were the first inhabitants of Europe. The speculations already published would fill volumes.

Dr. Harrison Allen, of Philadelphia, in the last number of the "Dental Cosmos," gives a more conservative view of the "jaw" question, saying, "certainly in the present state of our knowledge, it would be rash to assign the Abbeyville man to 'another' race, or, indeed, to any particular race, by the meagre evidence left us in a fragment of his jaw."

Dr. Packard questioned whether the antiquity of the gravel deposits containing the remains of prehistoric man in Europe, and the intensity of the climate of that period have not been exaggerated by writers, judging from the age and condition of our own river gravels, and from what must have been the climate of the Lake Period in North America, which could not have been much colder than that of Northern New England two hundred years ago. The "Lake Period" overlapped the Historic Period, and was not signalized by such a degree of Green-

land cold as to expel the Indian and fill their places with the Esquimaux.

He had seen native Esquimaux still living in the Straits of Belle Isle, about six hundred miles north of the parallel of Boston. The mound-builders, or "prehistoric men" of America, belong to a race much taller and stouter than the Esquimaux, and, it would seem, better developed physically and mentally than the present Indian races. Their mounds also seem older than the shell-heaps of our coast.

A special vote of thanks was passed to the several donors of specimens.

Le Roy F. Griffin, of Beverly; Hubbard Breed, of Salem; Edward H. Fletcher, of Salem, were elected Resident Members.

MONDAY, DECEMBER 16, 1867. Regular Meeting.

Vice President GOODELL in the chair.

Letters were announced from, — Passaic County Historical Society, Paterson, N. J. (Nov. 15); B. F. Owen, Astoria, Ill.; Henry B. Dawson, Morrisania, N. Y. (Nov. 26); James W. Harris, Cambridge (Dec. 4); Smithsonian Institution; Nantucket Athenæum (Dec. 6); Dr. B. Pickman, Boston; J. H. Vibbert, Rockport (Dec. 9); Frank A. Langmaid, Salem; Le Roy F. Griffin, Beverly (Dec. 12); Hubbard Breed, Boston; Charles H. Hart, Philadelphia (Dec. 13); Prof. Asa Gray, Cambridge (Dec. 14).

Donations to the Library were announced.

A. C. Goodell, jr., read the continuation of his paper on New England Hymnody and Psalmody.

Having devoted his first evening to a review of the progress of music in New England from the first settlement of the country to the present century, he devoted the second evening, on Monday, Dec. 16, to a consideration of psalmody and hymnody during the same period.

Very early in the progress of the Reformation hymns and spiritual songs had been composed for popular use by such men as John Huss and Martin Luther, among others. In Germany the Psalms were first metrically translated; but France brought psalm-singing universally into fashion through the version of Marot and Beza, which was sung by King Francis I. and his whole court.

Thomas Sternhold and John Hopkins attempted for England what Marot and Beza had done for France; and a sketch was given of the history of their version, — with the names of those who assisted in this labor, — of the popularity which it acquired, and of the means by which it became established in use in the English church.

The leading Puritan versions were then enumerated and discussed, including Ainsworth's, Barton's, and Rouse's; and the later versions of Woodford and Denham were compared with former versions.

The successful version of Tate and Brady in 1696 was then discussed, and compared with its predecessors.

While these changes were taking place in England, the congregations at Plymouth and in Salem were adhering, exclusively, to the ancient version of Ainsworth, — the latter until 1667, and the former until the union of the colonies under the Province Charter, — when they, respectively, adopted the Bay Psalm-book, as it is usually called, in conformity with general usage throughout New England. In Salem, however, both versions were used together after 1667.

The Bay Psalm-book was prepared by the Rev. John Eliot, best known as the "Apostle to the Indians," Rev. Thomas Welde, of Roxbury, and Rev. Richard Mather, of Dorchester. President Dunster, of Harvard College, and Mr. Richard Lyon, revised this version, which continued in general use in New England for more than a century, besides being adopted extensively in Great Britain.

The attempts of English writers to improve upon Tate and Brady were next traced, and the versions of Patrick and Sir Richard Blackmore were discussed.

Sir Richard Blackmore was the last of the leading versifiers in that period, which was fast drawing to its close, when the Psalms were considered the only legitimate subjects of sacred song; and although he had numerous panegyrists in his day, both here and in England, he is only preserved to fame by the accidental circumstance of his having quarrelled with Pope, — who more than once mentions him in the "Dunciad," — and in Dr. Johnson's biography.

The appearance of Dr. Watts's hymns was then noted as marking a new epoch in Psalmody, and his popularity was described.

Watts's "Hymns Sacred to Devotion," appeared in 1706, and all his earlier verses were collected and published under the title of "*Hymnæ Lyricæ*" in 1709. These were read and admired on both sides of the Atlantic.

With the verses of Tate and Brady, Denham, Patrick, Blackmore, and especially Watts, on every lip, and with such books as the *Spectator*, *De Foe*, and the *Essay on Man* for sale at the bookstores, New England not only began to swarm with professed admirers of the English hymn-writers and paraphrasts, but some very excellent imitators of the English school began to produce original pieces in the same vein, and the subject of improving the psalmody attracted general attention.

Opposed to these innovators was that never inconsiderable class of people who venerate tradition and esteem it a merit to bow to authority; and at their head stood forth some of the more conservative of the clergy. Two attempts to improve upon the New England version of the Psalms of David were made by two distinguished clergymen. The first was by Rev. John Barnard, of Marblehead, who, in 1752, put

forth his "New Version of the Psalms of David, fitted to the tunes used in the churches; with several hymns out of the Old and New Testaments." The second was by Rev. Thomas Prince of Boston.

At this point the speaker read and compared the 137th Psalm, as rendered in the different versions already described, including the versions of Prince and Barnard, both of whom were declared to be as well qualified for the work of improving our psalmody as any of their brethren. The character, position, and abilities of these reverend authors were described by the speaker, who proceeded then to show that their labors were unsuccessful against the popular tastes and the growing determination to substitute Watts's Imitations and other hymns of secular origin for the Psalms.

In considering the movement which led to the adoption of Watts's Imitations, Mr. Goodell referred to the Boston clergymen, Mather, Colman, Walter, and Mather Byles, describing their several labors in this behalf, noticing their terms of intimacy with English poetical writers, as Pope, Watts, and Blackmore; narrating many incidents illustrative of the zeal with which the satirists of the period engaged in the movement, and giving an account of the rapid decline of pure Psalmody, the present scarcity of the old psalm books, and quoting the very few stanzas now generally preserved out of those obsolete versions.

The services of Rev. John Todd, of Hanover Presbytery, Virginia, were noticed as having had a powerful effect in producing the change.

Although hymns of secular origin had been occasionally sung in Boston from as early as 1738, the innovation was far from general.

The Psalmody of Watts, however, we find generally introduced some years before the Revolution; the pioneers in this movement, as nearly as he could ascertain, being the society under the pastoral charge of Rev. Dudley Leavitt, of Salem.

As we approach the period of the Revolution, we find the same spirit of enterprise which has been commented upon in the previous paper on Sacred Music, exhibiting itself in its action upon our Psalmody.

Billings, whom we have seen leading off with his new system of musical instruction, and his loud and lively fugues, was the intimate friend of the great patriot Samuel Adams, — himself also a great singer, and was an equally ardent republican, — so for his new music he composed patriotic verses of the most singular character, and amongst the rest the 137th Psalm underwent the torture of a paraphrase, beginning

"By the rivers of Watertown we sat down and wept;
 "We wept when we remembered thee, O Boston!
 "As for our friends, Lord God of Heaven preserve them.
 "Defend them, deliver and restore them unto us again;
 "For they that held them in Bondage required of them
 "To take up arms against their brethren," etc.

A feeling, even, of dissatisfaction with Watts began to exhibit itself, almost as soon as his version had begun to be generally used; and this feeling was traced to the general improvement in literary taste, and to the evident superiority of the production of later writers.

Proceeding with his historical sketch Mr. Goodell referred to the hymns and compilations of Doddridge, Hart, the Wesleys, Mrs. Barbauld, Cowper, Ann Steele, and noticed the different editions of the verses of these authors that appeared in New England, with the date of each, commenting upon their influence here.

The selected Hymns and Psalms arranged by Joel Barlow, Timothy Dwight, and Dr. Bentley were described and the causes which led to these departures from the earlier editions of Watts's Imitations were pointed out.

The speaker finally declared that we were still, "to coin a word, in the *Wattsian* period." It has been estimated that fifty thousand copies of his sacred poems were, within a few years, annually sold in England and the United States.

Four principal defects of Watts's verses were enumerated, some one of which the speaker declared each new edition endeavors wholly or in part to remedy.

Our best hymns, or nearly all of them, have appeared since Watts's day. Some of these the speaker read, and commented upon the authors and editors of the best collections, alluding particularly to some American productions.

He concluded by venturing the prediction of still further improvement in hymnody, and the abandonment of much that a few years ago was prized so highly as to lead to the overthrow and rejection of the time-honored Psalmody of our New England fathers.

Wm. P. Upham, after some complimentary allusions to Mr. Goodell's two papers on New England church music, and expressions of satisfaction and pleasure which he had derived from listening to the reading, moved the adoption of the following vote, which was unanimously accepted:

Voted, That the thanks of the Institute be presented to Mr. Goodell for his able and highly interesting communications on church music in New England, and that a copy of the same be requested for reference to the publication committee to print in the Historical Collections, or otherwise, as may be deemed expedient.

Reuben Arey, John S. Jones, and Edward W. Jones, of Salem; J. Franklin Bly, John A. Putnam, John R. Longley, Warren Porter, Melvin B. Putnam, and William E. Putnam, of Danvers, were elected Resident Members.

MONDAY, DECEMBER 23, 1867. Regular Meeting.

Vice President GOODELL in the chair.

Letters were announced from, — John C. Wetmore, Essex, Mass. (Dec. 10); Prof. S. F. Baird, Smithsonian Institution (Dec. 16); Dr. T. A. Tellkampf, New York (Dec. 17); M. C. Cooke, London (Dec. 19); Dr. Harrison Allen, Philadelphia; A. M. Martin, Jamestown, N. Y.; J. A. Allen, Cambridge, Mass.; Dr. Elliott Coues, U. S. A., Columbia, S. C.; Rev. E. C. Bolles, Portland, Me. (Dec. 20); Messrs. Trübner & Co., London; Chas. G. Atkins, New England Commissioner of River Fisheries, Augusta, Me.; W. E. Bridges, Beverly, Mass. (Dec. 23).

Donations to the Museum were announced.

Charles K. Stevens presented some Arrow-heads and Chips found near the site of the Atlantic Mills in Lawrence, and made some observations on the Indian relics found in that region. He also presented some Red Coral from the Island of Goro, one of the Malta islands, and gave a brief account of the mode of procuring and preparing the same for commercial uses.

Edward S. Morse described the anatomical structure of this coral, and proceeded thence to speak of some of the naked mollusks as the Eolis, Doris, Elyria, and other genera, concluding with a succinct notice of the different forms of respiration among this class of the animal kingdom.

F. W. Putnam, in connection, alluded to the circulation and respiration of fishes and reptiles.

C. W. Felt read a letter from John J. Gould, of Wenham, asking information respecting the injury done to fruit by the puncture of bees, and a discussion followed on the question whether the abstraction of honey from the blossoms of our fruit trees by the bees effect in any manner the maturing of the fruit. Mr. Putnam expressed himself decidedly in favor of the bees, and thought that without the aid of the bees we should often be without fruit on some of our trees.

James W. Averill, of Salem, was elected a Resident Member.

MONDAY, DECEMBER 30, 1867. Regular Meeting.

Vice President GOODELL in the chair.

Letters were announced from, — Real Academia de Ciencias, Madrid (Nov. 12); British Archæological Association, London (Dec. 3); A. G. Browne, Salem (Dec. 18); H. B. Dawson, Morrisania, N. Y.; R. M. Chipman, East Granby, Conn. (Dec. 19); Edmund F. Slafter, Boston (Dec. 20); Prof. W. B. Rogers, Boston; James R. Newhall, Lynn (Dec. 22); I. T. Langworthy, Boston (Dec. 23).

Donations to the Library were announced.

James Kimball read a paper consisting of extracts from a journal

kept by his father, while one of a party of four Salem gentlemen travelling west on a business expedition, some fifty years ago. The great difference in modes of travel at that period and now was well portrayed, and exhibits the very wonderful advance that had been made. The party sailed to Baltimore in the schooner "Angler," Capt. John Shillaber; and on arriving there, waggons were chartered in which to cross the mountains to Pittsburgh. The mode of conveyance down the river in a sort of raft called an "ark," with accompanying incidents was alluded to. The largest steamboats in use at that time were four hundred or five hundred tons, and were mentioned in the Journal as of wonderful magnitude. The return trip occupied twenty-five days of horseback travel from Athens. It can now be accomplished in two.

A vote of thanks was passed to Mr. Kimball, and a copy requested for publication. (Printed in Historical Collections of the Institute, Vol. VIII.)

The Chair stated that since our last meeting Mr. W. P. Upham had found in the Court House the Records of the Court of Common Pleas during the time of Gov. Andros, and other ancient papers supposed to have been lost, and spoke of the importance to our history of the finding of these scattered links. He also gave some account of the complaints against Andros for his oppressive innovations, such as requiring persons to take out new deeds to confirm their titles to estates. Two of these old deeds are in the archives of the Institute, having the large wax seal attached.

W. P. Upham mentioned that a copy of the first book of Records of Salem had been made, and was placed at the disposal of the Institute, and that a copy of the Record of the First Church in Beverly had also been made, which might be printed at some future time. Mr. Upham hoped to be able, before long, to give a detailed account of the papers referred to by the chair as found in the Court House. Among them was an ancient copy of a part of the Records of the General Court.

Voted, — That the copy of the first book of Records of Salem be referred to the Publication Committee, with authority to print such portions as may be deemed advisable.

A. A. Abbott, of South Danvers, and Horatio G. Herrick, of Lawrence, were elected Resident Members.

*Additions to the Museum and Library during October,
November, and December, 1867.*

TO THE NATURAL HISTORY DEPARTMENT.

BY DONATION.

ATRY, GEORGE, Weymouth Point, Penobscot. A water-worn Stone, closely resembling a broken stone chisel, from Weymouth Point.

BABCOCK, AMORY L., Sherborn, Mass. Nine specimens of Skins and Skeletons of Birds, one skull of *Tamias striata*, and one of *Sitta socialis*. An alcoholic collection of Salamanders, Insects, and Spiders from Sherborn, and specimens of Lime Stone from Ohio.

BAKER, CHARLES, Wenham. Two specimens of *Goniaster* from Cuba.

BATES, JOHN, Danvers. A Stone Axe ploughed up in Danvers, Mass.

BICKNELL, E., Salem. A Mackerell Shark from Portland harbor.

BLAKE, SAMUEL, Ipswich. Fossils and Minerals from Wellsburg.

BRIDGES, M. E., Bangor, Me. A fresh specimen of the Great Horned Owl, *Bubo Virginianus* Bonp., from near Bangor.

BROOKHOUSE, R., Salem. A specimen of Ruddy Duck from the Chesapeake Bay.

BROWN, AUGUSTUS S., Salem. A specimen of the common Brown Bat from Salem.

BURNHAM, ROBERT, Essex. Two Stone Axes dug up in Essex.

CARLEN, SAMUEL, Salem. A very fine Nest of *Vespa maculata* from Beverly Woods; a specimen of the Red-throated Diver, shot in Salem.

CHEVER, G. F., Salem. A specimen of Mica from Grafton, New Hampshire.

CHOATE, JOHN, Essex, Mass. A Stone Sinker of peculiar form found in Essex.

COOKE, C., Salem. Parasitic Flies from the "Great Horned Owl" from Salem.

COX, E. T., New Harmony, Ind. Specimens of three species of Dip-terous Larvæ from the Equality Salt Works, Indiana.

CREESY, Mrs. J. B., Beverly. A resinous substance washed ashore at Seconset Beach.

DODGE, WINTHROP L., Hamilton. A Stone Arrow-head found on his farm in the western part of Hamilton, differing very much in form from those usually found in that vicinity.

EMERTON, J. H., Salem. Insects from Ipswich, collected Oct. 7, 1867.

FOWLER, AUGUSTUS, Danvers. A fresh specimen of Whippoorwill from Danvers.

FULLER, THOMAS, Bedford, Mass. A fresh specimen of Goss-hawk, ♀, young, from Boxford, Mass.

GALLOUPE, CHARLES W., Boston. A collection of Minerals, principally from the Provinces.

GARDNER, WILLIAM F., Salem. A specimen of *Necrodes Surinamensis* from Salem.

GILLMAN, HENRY, Detroit, Mich. A collection of Insects in alcohol from Lake Superior.

Goss, F. P., Salem. A specimen of *Belostoma* sp. from ?

HADDOCK, JAMES M., Salem. The skin of a Toucan, and a Vase made of the fruit of the Kanare-ma-kak from Cayenne.

HAMMOND, Capt. JOSEPH, Salem. A specimen of *Sphyræna* (young) from the South Atlantic Ocean.

HAMMOND, WILLIAM H. A Spider, *Mygale*, from Africa.

HASKELL, JOSHUA P., Marblehead. Fish and Insects from Marblehead..

HOWELL, ROBERT, Nichols, Tioga Co., N. Y. A collection of Fossils from New York, and a collection of Fishes from Nichols, Tioga Co., N. Y.

KENDALL, Mrs. PRISCILLA, Salem. A very large and fine Nest of *Vespa maculata* from Dunstable, Mass.

KILLAM, Mr., Topsfield. A fresh specimen of Goss-hawk, ♀, young, from Topsfield, Mass.

KINSMAN, ALBERT S., Salem. Fossils from Springfield, Ohio, and a portion of a Jar dug out of a mound near Springfield.

KINSMAN, JACOB, Topsfield, Mass. A Stone Gouge ploughed up at Topsfield, with portions of an Indian Skeleton.

KITTREDGE, Miss HELEN M., Beverly. An ancient Lamp found among the ruins of the palace of the Cesars; a specimen of Coral from the Blue Grotto at Capri.

LANDER, W. W., Salem. Specimens of Ants just swarming, collected at the Salem post-office.

LINCEUM, G., Long Point, Texas. A very fine collection of Insects, mostly Hymenoptera, from Texas.

MANNING, Capt., Salem. A specimen of the "Great Horned Owl" killed in Salem.

MARKS, JOHN L. Specimens of Building Stone from Junction City, Kansas.

OWEN, Prof. RICHARD, Bloomington, Ind. A collection of Fishes, Reptiles, etc. in alcohol; specimens of Aphides, and Oats with Aphides still clinging to them; also Hornbeam leaves with conical nidus of Aphides.

PACKARD, Dr. A. S., Jr., Salem. Insects, Myriapods, and Worms from Westport, N. Y., collected Aug. 26, 1867; also, Insects from the Adirondack Mountains.

PARKER, E. H., Salem. A Stone Axe found on the Saganaw River, Michigan.

PERKINS, EBEN, Essex. Several Stones probably worked by the Indians, ploughed up in a field in Essex; also, one Silver and seven Copper Coins of different countries.

PERKINS, ELBRIDGE, Essex, Mass. A Stone worked by the Indians, ploughed up at Essex, and an unfinished Arrow-head found at the same place.

PHELPS, CHARLES, Middleton. A Stone Sinker, used by the Indians, found at Middleton.

PHELPS, WILLIAM A., Middleton. An Indian Arrow-head found at Middleton; portion of an Indian Skeleton dug up on the land of Mr. Jessie W. Peabody; and a Stone Hatchet from Middleton.

MESSRS. PUTNAM, BICKNELL, and MORSE, Salem. A collection of remains from the Shell-heaps on Goose Island, Casco Bay.

RICHARDS, W. W., Salem. A Monkey from the coast of ?

ROBINSON, JOHN, Salem. A Feather Cape from ?

SEARS JOHN H., Danvers. A specimen of the Common Weasel; a living specimen of *Nyctale acadica* from Danvers.

SMITH, EDMUND. A fresh specimen of Blue Heron shot at Plum Island.

SHATSWELL, JOSEPH, Salem. A specimen of *Scolopendra*, locality unknown, and a piece of the Keel of a Fishing Vessel eaten by the Toredos, in Boston Harbor, in the year 1831. The vessel was a new one, and was eaten to this extent in one season.

STANWOOD, EBENEZER, Essex. An unfinished Arrow-head found at Essex.

STATEN, Mrs. D. F., Salem. Sixty-eight specimens, comprising twenty-five species of shells from Florida.

STEVENS, CHARLES K., Salem. A piece of the Red Coral of Commerce from near Malta; also several Arrow-heads and chippings of Stone from Lawrence, Mass.

STOREY, A. E. Skeleton of a Bat found in the State House, Boston.

TABOUR, WILLIAM, Salem. A piece of Burrstone containing a cast of *Cardium* sp., locality unknown.

WAIT, FRANCIS P., Ipswich. Indian Implements found on the County House Farm at Ipswich.

WATERS, DAVID P., Salem. A fresh specimen of the Short-eared Owl from Salem.

WETMORE, JOHN C., Essex, Mass. Portions of an Indian Skeleton found on his land in Essex; also a Flat Rock, one of three, found under another skeleton from the same place.

WHEATLAND, Miss M. G., Salem. Pieces of broken Pottery from Indian graves at Lake Harney, Florida.

WILLARD, Capt. B. J., Portland, Me. The carcass of a Black-fish twelve feet long, from Portland Harbor.

WYMAN, THEODORE, Salem. Seeds from Hyer's Valley, Cal., and the Isthmus of Darien; specimens of Copper Pyrites from California.

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COMMUNICATIONS.

1866-7.

**Communications on Historical subjects are printed in the
"HISTORICAL COLLECTIONS OF THE ESSEX INSTITUTE."**

I. *Prodrome of a Monograph of the Pinnipedes.*

BY THEODORE GILL.

(Communicated October 16, 1865.)

The Seals of America have been hitherto little known, and in the general works on the mammals of the northern continent, they, like the bats and cetaceans, have been omitted.

With a view to the elucidation of the species, and at the suggestion of Professor Baird, I have been induced to undertake the examination of the collection of specimens in skin, and the skulls and skeletons possessed by the Smithsonian Institution and the Academy of Natural Sciences of Philadelphia. To Mr. F. W. Putnam, Superintendent of the Museum of the Essex Institute, and Professor Wyman, I am much indebted for the kindness manifested in transmitting to me the specimens they possessed, and the opportunity thus afforded for comparison and study of more extensive material. The results of the examination of these specimens are now given, in so far as the classification and relations of the primary groups and genera are concerned, while I am obliged to defer until a more convenient season the more elaborate exposition of the views I have been compelled to embrace, as well as the discussion of the limits and nomenclature of the species.

Passing over the changes which the seal exhibits in its progress to adolescence, I would advert to the peculiarities in the geographical distribution of the several groups in connection with their systematic relations.

The three primary groups which may be elevated to the rank of families, in the first place, are very differently distributed.

The PHOCIDÆ are cosmopolitan, and representatives are found in the tropical seas, as well as in the waters of the extremest north and south, the Indian Ocean being the only large body of water in which no species are found. While such, however, is the expression of the general distribution of the family, its minor groups are much more narrowly restricted. The three subfamilies, into which the family is divided, are each distinguished by peculiarities in limitation. The PHOCINÆ are almost confined to the polar and northern temperate seas, representatives of a single genus extending southwards to or beyond the tropic of Cancer,* while the STENORHYNCHINÆ, after the exclusion of *Monachus*, whose affinities are essentially with the *Phocina*, are confined as strictly to the opposite hemisphere. The CYSTOPHORINÆ, on the other hand, are represented at both extremes; the species of one genus, *Cystophora*, inhabiting the Arctic seas, whence it descends into the more northern temperate Atlantic on both sides; while *Macrorhinus* is represented by a species found in the Antarctic seas, whence it advances to the Patagonian shores and the Pacific coast of temperate South America, the southern Australian seas and the Cape of Good Hope, and on the other side of the Equator, but still in the Pacific ocean, is replaced by a species peculiar to the warmer waters that bound the North American continent on the west. The exact limits of these species require, however, yet to be ascertained. The ROSMARIDÆ are entirely confined to the northern Polar seas. The OTARIIDÆ have their metropolis in the Pacific ocean, and are represented by species along

* The "*Halichærus antarcticus*" of Peale, very erroneously identified with *Lobodon carcinophaga* by Dr. J. E. Gray, is a typical species of *Phoca*, but appears to be identical with a species occurring along the California and Oregonian coasts, and, consequently there must be some error as to its assigned habitat in the antarctic seas. I am happy to add that Mr. Peale himself now doubts the correctness of the labels on the faith of which he gave its habitat, and as a change of name is desirable, I would propose that of *P. Pealii*.

The relations of the Jamaican seal, rejoicing in the two names, *Phoca tropicalis* Gray and ———? ! *Wilkinson* Gosse (1851), are very uncertain. Mr. Gosse obtained a single skin. The exact origin of the *Cystophora antillarum* was not mentioned in the original description, and its West Indian habitat requires confirmation.

the entire western coast of America, except the tropical regions, while on the eastern they ascend towards Brazil. They are likewise abundant along the Australian coasts.

In conclusion, it may be added, as Peron and Dr. Gray have before insisted, that the species of the entire group are restricted within as distinct geographical limits as are any other mammals, and as are especially the marine fishes.

Without further preface, I submit the following classification to the judgement of naturalists:

FAMILY I. PHOCIDÆ Brookes, Gervais.

SUBFAMILY I. PHOCINÆ (Gray), Gill.

GENUS 1. PHOCA Linnæus.

SYN. *Callocephalus* F. Cuvier, 1824, Gray, 1844.
Halicyon Gray, 1864.

Type. *PHOCA VITULINA* Linnæus.*

GENUS 2. PAGOMYS Gray, 1864.

Type. *PHOCA FETIDA* Müller.

GENUS 3. PAGOPHILUS Gray, 1844.

Type. *PHOCA GRÆNLANDICA* Müller.

GENUS 4. ERIGNATHUS Gill, 1865.

SYN. *Phoca* Gray, 1844.

Type. *PHOCA BARBATA* Fabricius.

GENUS 5. HALICHÆRUS Nilsson, 1820.

Type. *PHOCA GRYPUS* Fabricius.

* In the Syst. Nat. 10th ed., 1758, the first in which the binomial system was introduced, four species were included by Linnæus in the genus PHOCA; 1, *P. ursina*, = ARCTOCEPHALUS URSINUS; 2, *P. leonina*, = MACRORHINUS LEONINUS; 3, *P. rosmarus*, = ROSMARUS OBESUS; 4, *P. vitulina*. The name PHOCA must be retained for one of these, and as the third, second and first species were successively elevated to the rank of generic types, and the genus was thus by elimination restricted to the fourth species, for that and its allies, the generic name must necessarily be reserved.

GENUS 6. *MONACHUS* Fleming, 1822, Gray, 1850.

SYN. *Pelagios* F. Cuvier, 1824, Gray, 1844.

Heliophoca Gray, 1854.

Type. *PHOCA MONACHUS* Hermann.

SUBFAMILY II. CYSTOPHORINÆ Gray.

GENUS 7. *CYSTOPHORA* (Nilsson, 1820), Gray, 1844.

SYN. *Stemmatopus* F. Cuvier, 1824.

Type. *PHOCA CRISTATA* Erxleben.

GENUS 8. *MACRORHINUS* F. Cuvier, 1824.

SYN. *Mirounga* Gray, 1827.

Macrorhyna Gray, 1827.

Morunga Gray, 1844.

Type. *PHOCA LEONINA* Linnaeus, 1758.

SUBFAMILY III. STENORHYNCHINÆ (Gray), Gill.

GENUS 9. *LOBODON* Gray, 1844.

Type. *PHOCA CARCINOPHAGA* Hombron and Jacquinot.*

GENUS 10. *STENORHYNCHUS* F. Cuvier, 1824.

Type. *PHOCA LEPTONYX* Blainville.

GENUS 11. *LEPTONYX* Gray, 1836.

Type. *STENORHYNCHUS WEDDELLII* Lesson.

GENUS 12. *OMMATOPHOCA* Gray, 1844.

Type. *OMMATOPHOCA ROSSII* Gray.

* The *Halicheerus antarcticus* Peale, referred by subsequent authors to *Lobodon carcinophaga*, has no affinity with it. The species is a typical *Phoca*, closely allied to *P. vitulina*, and was correctly described by Mr. Peale. The type specimens of skins and skull are in the Smithsonian Museum.

FAMILY II. OTARIIDÆ Brookes, Gervais.

GENUS 1. OTARIA Peron, 1816.

SYN. *Platyrrhynchus* F. Cuvier, 1824.

Otoes Fischer.

Platyrrhinus Lesson.

Ottophoca Blainville.

Type. *PHOCA JUBATA* Schreber.

GENUS 2. ARCTOCEPHALUS F. Cuvier,* 1824.

SYN. *Callorhinus* Gray, 1864.

Type. *PHOCA URSINA* Linnæus.

GENUS 3. EUMETOPIAS Gill, 1865.

Type. OTARIA CALIFORNIANA Lesson., = ARCTOCEPHALUS MONTERIENSIS Gray.†

GENUS 4. ZALOPHUS Gill, 1865.

Type. OTARIA GILLIESPII Macbain.

GENUS 5. HALARCTUS Gill, 1865.

Type. ARCTOCEPHALUS DELALANDII Gray.

FAMILY III. ROSMARIDÆ Gill.

SYN. *Trichechidæ* Brookes, Gervais.

GENUS 1. ROSMARUS Scopoli, 1777.

SYN. *Odobænus* (Brisson), Illiger.

Trichechus Auct. recent.‡

Type. TRICHECHUS ROSMARUS Linnæus.

* ARCTOCEPHALUS F. Cuv. was especially established for a species considered identical with *Phoca ursina* Linn, and as no other species was mentioned, and, as the identification appears correct, the name must be retained for that species.

† Is not *A. monteriensis* Gray identical with *Otaria Stelleri* Mull. Arc. fur Nat. 1841, I. 330?

‡ TRICHECHUS was originally based solely on the Manati (*T. Manatus*) by Linnæus, Syst. Nat. 10 ed. 1758, I. 34. It must therefore be retained for that animal.

These families, subfamilies and genera may be distinguished as follows:

PHOCIDÆ.

The Phocidæ are the most elongated in form, and have the external ears obsolescent. The skull has the postorbital processes null or obsolete; "no alisphenoid canal; the mastoid processes swollen and seeming to form part of the auditory bulla."* Incisors $\frac{6}{4}$; $\frac{4}{4}$; $\frac{4}{2}$. Canine teeth normally developed. Molars $\frac{5}{5}$ | $\frac{5}{5}$; rarely $\frac{6}{5}$ | $\frac{6}{5}$ (in *Ommatophoca*). Anterior and posterior feet provided with claws; the anterior legs smaller than the posterior, with the digits of the feet successively abbreviated; the posterior flippers emarginated; the third and fourth digits being shortest. Scapula in the Phocinæ expanded upward and backward toward the postero-superior angle, the surface behind the spine being enlarged.

In the family, thus limited, three subordinate types are embraced, which may be distinguished as subfamilies. These are especially differentiated by modifications of the skull and feet. In the discrimination of the genera, many characters have been omitted, as unadvisable to introduce in a mere synopsis. Most of the characters selected for the distinction of the subfamilies have been hitherto overlooked. Their universality and their coincidence have been verified by reference to all the known types. †

PHOCINÆ (Gray.)

Maxillar zygomatic process with the posterior surface subvertical, or very oblique. Malar oblong-rhomboid, emarginated above and below. Intermaxillaries narrow, prolonged, and wedged behind between the supramaxillaries and nasals. Nasal bones narrow, diminishing in width backwards. Incisors $\frac{6}{4}$; exceptionally $\frac{4}{4}$.

* TURNER. *Proc. Zool. Soc. London*, 1848, p. 88. The constancy of the characters used by Turner has been verified by myself, by reference to all the types.

† The genera *Monachus*, *Lobodon*, *Leptonyx* and *Ommatophoca* are autotopically unknown to me, but the published illustrations demonstrate the applicability of the characters in question.

Synopsis of genera.

*Incisors $\frac{6}{2}$; curved, conic, small. Bony palate produced forward between lateral extensions of the maxillaries, quite or nearly to a line with the posterior molars.

† Skull declining at nasal region; anterior nares moderate; molars, except first, with two roots.

‡ Maxillar zygomatic processes arising from edge of jaw, with the surface very oblique and the suborbital foramen inferior. Jaws rectilinear.

a. Lower jaw with its branches flattened within. Teeth complex.

PHOCA.

b. Lower jaw with its branches inflected inwards. Teeth simple.

1. Palate emarginated behind; very deeply incised at the septum narium.

PAGOMYS.

2. Palate entire and transverse behind; septum narium entire and continued to the posterior edge of palate.

PAGOPHILUS.

‡‡ Maxillar zygomatic process high up, with the surface little oblique, and the suborbital foramen anterior. Jaws curved outward. Palate very broad, emarginated. Base of skull with posterior lateral vacuities obsolete.

ERIGNATHUS.

†† Skull increasing in height forward. Anterior nares very large; molars single rooted.

HALICHERUS.*

** Incisors $\frac{4}{2}$; enlarged, transversely notched behind their edges. Bony palate emarginated behind and with a notch at suture; the bones not produced as far forward as the inner margin of orbit.

MONACHUS.†

CYSTOPHORINÆ Gray.

Maxillar zygomatic process with the posterior surface subvertical, or very oblique. Malar bone elongate-rhomboid, emarginated above and below. Intermaxillaries terminating far from nasals. Nasal bones narrow and rather short. Incisors $\frac{4}{2}$.

Synopsis of genera.

* Bony palate nearly square, subtruncated behind. Adult males with a large dilatable compressed hood extending from the nose to occiput.

CYSTOPHORA.

** Bony palate very short, emarginated by a deep sinus behind. Adult males with an extensible tubular proboscis.

MACRORHINUS.

*The affinity of *Halicherus* to *Rosmarus* (*Trichechus* Auct.) is not evident.

†*Monachus*, approximated by all preceding naturalists to the *Stenorhynchus*, appears to be far more nearly related to the *Phoca*.

STENORHYNCHINÆ (Gray.)

Maxillar zygomatic process with its lower and posterior surface extended horizontally backwards, and its angle continued far behind along the inner side of the malar. Malar elongated, bow-shaped, and curved upward in front. Intermaxillaries narrow, not continued backward between nasals and supramaxillaries. Nasal cavity expanded, with the nasal bones widest toward the middle, and very long. Incisors $\frac{4}{1}$.

Synopsis of Genera.

1. Molars $\frac{5}{8}$; deeply lobed. Snout much longer than orbits, which are moderate.

* Molars (except first) unequally lobed, with a large recurved lobe; a small one in front, and two or three behind. Occipital condyles widely diverging upward.

LOBODON.

** Molars trilobed. Occipital condyles nearly parallel.

STENORHYNCHUS.

2. Molars $\frac{4}{2}$; "with a small conical tubercle on the hinder edge, and a sharp edged ridge round the inner side of the base." Snout shorter than the orbits, which are rather large.

LEPTONYX

3. Molars $\frac{6}{3}$; "compressed, with a central incurved lobe, and a small lobe on each side of it." Snout shorter than the orbits, which are very large.

OMMATOPHOCA.

OTARIIDÆ.

The Otariidæ are less attenuated than the Phocidæ and have distinct external ears. The skull has "a post-orbital process; an alisphenoid canal; mastoid process strong and salient, standing aloof from the auditory bulla" (Turner). Incisors $\frac{2}{1}$. Canines normally developed. Molars $\frac{4}{3} | \frac{4}{3}$ or $\frac{6}{3} | \frac{6}{3}$. Anterior legs about as large as the posterior, their toes decreasing in a curved line, and without claws; posterior feet, with the digits nearly coterminous, with long, membranaceous longuiform flaps extending beyond their tips, and with the three median toes only clawed. Scapula curved backward to the upper angle, but with its spine or crest near the posterior margin.*

* It may also be remarked that the nasals are as wide behind as in front, extending toward their externo-posterior angles, and receive between their produced portions a triangular extension of the frontal bones.

This family, especially developed in the Pacific, is represented by several genera, which may be distinguished as follows:—

I. Palatal surface of maxillaries extending behind the teeth, and with its posterior processes very long. Bony palate extending nearly to the pterygoid processes and truncated or convex behind. OTARIA.*

II. Palatal surface of maxillaries at middle not extending beyond the grinders, and with moderate lateral extensions. Bony palate very deeply emarginated.

a. Face high, boldly decurved and shorter than orbit. Molars $\frac{6}{5}$; approximated, compressed, conic.

ARCTOCEPHALUS.†

b. Face produced, longer than orbit.

1. Molars $\frac{6}{5}$; last upper far behind the inner margin of orbit. Posterior nares very high and narrow. Bony palate with a very narrow emargination, notched at suture. Forehead very thick and tumid, with a triangular flattened area. Postorbital processes quadrate. EUMETOPHUS.

2. Molars $\frac{6}{5}$; approximated; last under zygomatic process; posterior nares wider than high behind. Bony palate with a continuous concave emargination behind. Forehead, depressed, with triangular postorbital processes. Occipital crest very high. ZALOPHUS.

3. Molars $\frac{6}{5}$; lower more or less trilobate; last upper behind inner margin of zygomatic process. HALARCTUS.

ROSMARIDÆ.

The Walruses have a very robust body, and no external ears. The skull provided with "no postorbital processes; a distinct alisphenoid canal; mastoid process strong and salient; its surface continuous with the auditory bulla" (Turner). Incisors deciduous; the external on each side being alone retained in the gums. Canines extraordinarily

* *Otaria* is said by Dr. Gray, in his last enumeration of the family, to have "the palate very concave, decurved deeper with age, &c." I cannot understand such a statement with regard to the bony palate of *Otaria leonina*, and consequently describe the appearance of the bones as they appear to me.

† As I have known it to be suggested that the *A. monteriensis* and *A. Gilliespii* may be identical, it may be proper to state that the first is not found in the South, where the other species dwell, although the second may inhabit the same regions in the North. The differences between the three species are so great, that it may be almost a matter of surprise that they should not have been generically separated before. I have examined the complete skeleton and three skulls of adults of *A. monteriensis*; the skull of a very old male of *A. Gilliespii*; and skulls of five young specimens of *A. ursinus*, besides part of the skeleton.

developed as tusks. Molars in young $\frac{5}{4}$; the fifth and fourth caducous. Anterior feet about as large as posterior, with the toes decreasing in a curved line, destitute of claws; the posterior feet with the five digits, scarcely increasing toward inner, all provided with claws. Scapula with the hinder margin nearly straight, and the spine a short distance from, and somewhat parallel with it.

* One genus.

ROSMARUS.

APPENDIX.

For the benefit of American naturalists, a list of the species of Seals inhabiting both coasts of North America, is here given. I may add that I have seen more or less numerous specimens of every species enumerated.

Pinnipedes of Eastern North America.

PHOCIDÆ.

PHOCINÆ.

1. *Phoca vitulina* Linnæus. Greenland to New York.
2. *Pagomys fœtidus* Gray. Greenland to Labrador.*
3. *Pagophilus grœlandicus* Gray. Greenland to Gulf of St. Lawrence.
4. *Erignathus barbatus* Gill. Greenland to Gulf of St. Lawrence.
5. *Halichærus grypus* Nilsson.† Sable Island.

* The *Phoca fœtida* and *P. hispida* appear to simply represent conditions of a single species exhibiting a remarkable variation in dentition. An examination of numerous specimens, differing in the number of the cusps, forbids my considering such variations as constant and indicative of specific value. They surely cannot be generically separated as Dr. Gray has done.

† The American form of *Halichærus* differs somewhat from any of the three forms signalized by Hornschuch, but the names of that gentleman have not been regarded by others as the expression of valid species, and do not really appear to merit recognition. I have therefore, provisionally at least, identified the American type with the European, combining all the known forms of the genus under one specific name.

CYSTOPHORINÆ.

6. *Cystophora cristata* Nilsson. Greenland to New York.

ROSMARIDÆ.

7. *Rosmarus obesus* Gill ex Illiger. Greenland to Labrador; formerly to Nova Scotia.

Pinnipedes of California, Oregon, &c.

PHOCIDÆ.

PHOCINÆ.

1. *Phoca Richardi* Gill ex Gray. British Columbia, (southwards, to California?)
 2. *Phoca Pealii* Gill. California and Oregon.

CYSTOPHORINÆ.

3. *Macrorhinus angustirostris* Gill.* California.

OTARIIDÆ.

4. *Arctocephalus ursinus* F. Cuvier. Behring's Straits to Washington Territory.
 5. *Eumetopias californianus* Gill.† California.
 6. *Zalophus Gilliespii* Gill ex Macbain. South California.

ROSMARIDÆ.

7. *Rosmarus obesus* Gill ex Illiger. Arctic Seas.

* *Macrorhinus angustirostris* is distinguished by its narrow snout, and the form of the palatine bones, &c. It will be described in the Proc. Chicago Acad. Nat. Sc.

† The *Eumetopias californianus* is identical with the *Otaria monteriensis* of Gray, and possibly also with *Otaria Stelleri* Muller.

II. *Notice of a Foray of a Colony of Formica sanguinea Latr. upon a Colony of a black species of Formica, for the purpose of making slaves of the latter.*

BY J. A. ALLEN.

(Communicated February 20, 1865.)

Conflicts between colonies of Ants have been repeatedly witnessed, in various countries and by different observers, and the fact that some species attack other species for the purpose of capturing and making slaves of them, or of their young, has been ascertained beyond question; accounts of which may be found in most general entomological works that treat upon the habits of insects. Such instances, however, are rarely observed, and, as the writer knows of no published account of any having been witnessed in this country, he is induced to give a short account of a case of this character that came under his notice the past season at Springfield, Mass.

On the 30th of July, about eight in the morning, while walking near the edge of a thicket, in an old pasture, my attention was attracted by a procession of ants, considered by Mr. Uhler to be the *Formica sanguinea* Latr.,* passing to and fro in the grass. Stooping to examine them more closely, I noticed that all those going in one direction were carrying in their mandibles larvæ and fully grown ants of another species. Following the train to its end in one direction, and then in the other, I had no difficulty in finding where the captives were deposited and whence they were obtained. The formicaries of the two colonies I found to be fully fifty yards apart. After watching them carefully for a time I left them, and returned in half an hour with means for collecting; when I found them still as busily employed as at first. I then secured many specimens of both captors and captives; a part of the latter were young, but able to run about, and quite dusky in color,

* I am indebted to the kindness of Mr. P. R. Uhler, of the Museum of Comparative Zoölogy, to whom I referred the specimens, for the identification of this species, which appears to be widely distributed in both Europe and North America.

while others were still white, having just left the pupa case.* My operations produced great agitation in the ranks of the plundering species, information of the disturbance spreading so rapidly, that, in a few seconds, scores had come together, where there were but three or four before, exceedingly irritated and eager to fasten on my forceps and hands. I collected at different points along the train, with invariably the same behaviour on the part of the ants, they immediately gathering about me, coming from both directions. I noticed that, within a few minutes after I first molested them, the procession began to diminish in that portion towards the plundered ant hill, and ten minutes after only a few of the *F. sanguinea* could be seen, and these were near their own galleries, each returning with its captive. Whether they had finished their labor for the morning, or suspended it on account of being molested, I could not fully ascertain, though it was probably the former. An examination of the plundered mound, made a few hours after, when perfect quiet had returned, showed that it had not been fully exhausted of its inhabitants; a few of the old ants remained, as well as an abundance of their helpless young. A few of the *F. sanguinea* were also there, apparently left as a garrison. On disturbing the colony of *F. sanguinea* both species came out, but the captives were much less in number and did not manifest the rage exhibited by the proprietors. Examining the formicaries of both species two days later, the plundered one was found entirely empty, all of both adults and young having been removed, while the other was well stocked with both species, the slaves, however, being much less in number than the *F. sanguinea*, and much less earnest in resisting my attack.

The species, upon which the foray of *Formica sanguinea* in this instance was made, was an ant entirely black in color, rather larger in size than the *F. sanguinea*, but evidently a weaker species, having a smaller head, slenderer antennæ, legs and thorax, but a larger abdomen. It is possibly a species common to both Europe and North America, though it may prove to be undescribed. The young,

* A few of these specimens have been communicated to the Essex Institute, and the remainder to the Museum of Comparative Zoölogy.

as already stated, were in various stages of maturity; some of the more advanced that I kept alive became completely black during the day, and thus not to be distinguished from the adult.

F. sanguinea, as I observed in several cases, seized its victim by the mandibles; and weeks after, in looking over the collection I had kept in alcohol, I found several pairs with the mandibles still locked. Mr. F. Smith, in his catalogue of the Hymenoptera of the British Museum, part VI, (Formicidæ) p. 4, says: "This is the only species of the genus *Formica* which plunders the nests of other species of their young brood in the pupa state, which they bring up as slaves to their own community. The species is not uncommon in Hampshire (England), where it attacks the nests of *F. fusca* and *F. cunicularia*; in its nests have also been observed numerous individuals of the yellow ant, *F. flava*; it does not raise nests similar to the wood-ant, but belongs to the division of mining ants." In the case of the present colony, its galleries were completely subterranean; there were no surface indications of the existence of the formicary. The site of the colony of the black species was indicated by a slight mound of earth. The well known slave-making ant, whose interesting habits have been so minutely described by Huber, is the *Polyergus rufescens* Latr., found in Central Europe.

There had evidently occurred a battle between the two colonies of ants under consideration, as I noticed that some of the *F. sanguinea* first examined were carrying mutilated individuals of their own species. The conflict was probably a short one, *F. sanguinea* so much outnumbering the other species. The latter appeared, when I saw them, to have resigned themselves to their fate, offering not the least resistance; and when liberated from the firm grasp of their captors, they only very spiritlessly sought at once to hide under the first fragment of grass or other thing that would conceal them, under which they quietly remained. The number of *F. sanguinea* engaged in the foray I estimated at nearly two thousand, there being in the procession as many as eight or nine hundred at once, while at the same time there were probably as many or more in the two formicaries.

III. *Synopsis of the Polyps and Corals of the North Pacific Exploring Expedition, under Commodore C. Ringgold and Captain John Rodgers, U. S. N., from 1853 to 1856. Collected by Dr. Wm. Stimpson, Naturalist to the Expedition. With Descriptions of some additional Species from the West Coast of North America.*

BY A. E. VERRILL.

PART III. MADREPORARIA. With two Plates.

[Communicated February 29, 1865.]

In a natural arrangement of Polyps, as stated in Part I. of this series, the order ACTINARIA should follow the ALCYONARIA, they standing next to them in grade, as is shown by many features of their structure. Thus the Actinidæ have a highly specialized muscular basal region, which is used in locomotion in various forms; they have a more highly developed tentacular system than the Madreporaria, these organs often being variously branched or lobed; and frequently there are various other ambulacral organs, either within the tentacles, around the mouth, or on the sides below the tentacles, such as lobed or foliaceous appendages for respiration or adhesion, colored spherules, perhaps organs of visual sense, suckers, cinclidæ, pores, tubercles, &c., nearly all of which are wanting in the present order. The walls also are highly muscular throughout, while in MADREPORARIA the lower portion becomes solidified by calcareous deposits and serves merely for attachment or protection.

Again, if we take into consideration the number or repetition of the lateral homologous elements or spheromeres around the longitudinal axis, or rather on the two sides of a median plane, we find that in each order there are genera having a definite and small number, which in *Madrepora* is twelve, as in *Peachia* and other *Actinia*, while other genera in each have a large number, increasing indefinitely (as *Fungia* in MADREPORARIA, *Metridium*, &c. in ACTINARIA). While, therefore, this character can be used only to indicate grade within each order, it is nevertheless true that the ACTINARIA present some genera in which the number is six, the

smallest consistent with their structure (*Antipathes*, &c.) and several others in which it is constantly twelve, but the smallest number of tentacles observed in any well formed individual of MADREPORARIA is twelve, as in *Porites*, *Madrepora*, &c.

The bilateral arrangement of parts is very well brought out in each order, but, perhaps, as strongly as in any in some ACTINIAE in which the mouth is oblong and furnished with peculiar tubercles in pairs on the sides, but differing entirely at its opposite ends (*Peachia*, *Siphonactinia*, &c.). In other cases one of the tentacles in the median plane is much longer or differs in color and structure from the rest.

The character of being simple or compound, which has been referred to by some authors as indicating grade, seems to be of little or no importance. In each of the two orders under consideration, both simple and compound species occur, and sometimes within the same natural family, while many that are simple when fully grown, doubtless increase while young by fissiparity or gemmation. There seems at least to be no reason to suppose that a compound attached Madrepora is so highly organized as the freely moving Actinia, which has a far more highly complicated structure and more diversified functions.

In the present article, however, it has been found more convenient, on account of the arrangement of the plates, to take up the Actinaria after the Madreporaria.

ORDER, MADREPORARIA Edw. and Haime, restricted.

This division I have raised to the rank of an order, thus making it parallel with ALCYONARIA, long since separated by Milne Edwards, Blainville, and others, as well as with ACTINARIA, which has hitherto been united with it, either as a suborder, or more intimately combined, so that sometimes, even in recent works, families of the two groups are placed, in close proximity within the same tribe.

The group itself, however, has been recognized as a natural one by several authors, and the same limits have been assigned to it as I have given, with the exception of some

genera more recently referred to other classes, and especially the Tabulate corals, which were included by Milne Edwards and Haime, but which, according to the observations of Prof. Agassiz, who has seen the Polyyps of *Millepora*¹, belong among the HYDROIDEA. This genus, however, was not united with the group of *Zoanthaires* by Blainville, but with the *Bryozoa* or Polypoid Mollusks.

Exclusive of the exceptional genera, this order corresponds to the great genus *Madrepora* of Linnæus, Pallas, Ellis, Esper and other writers of the last century; to the section *Polypiers lamellifères* of Lamarck² and Lamouroux³; to the group of *Zoanthaires pierreux* of Blainville⁴; to part of the suborder *Actinaria* of Dana⁵, Agassiz⁶ and others; and to the third suborder of *Zoanthairia*, named MADREPORARIA, in the works of Milne Edwards and Haime⁷. The latter arrangement I have adopted in a former paper⁸.

This order has been sufficiently characterized for my present purpose in the Synopsis of the Classification⁹, as well as its subdivisions and principal families.

SUBORDER, MADREPORACEA Dana, pars.

FAMILY, MADREPORIDÆ Dana.

MADREPORA TURGIDA Verrill, nov. sp.

The corallum consists of a cluster of thick, irregular branches arising from a large massive base. The branches are short and turgid, rounded and elevated at the ends, or

1 Contributions to the Nat. Hist. U. S., Vol. III., page 61.

2 Histoire des Animaux sans vertèbres, t. II., 1816.

3 Exposition methodique, 1821.

4 Dictionnaire des Sci. naturelles, 1830, and Manual d' actinol., 1834.

5 Zoöphytes of the U. S. Expl. Exp., 1846.

6 Contributions to the Natural Hist. of the U. S. Vol. I, p. 151, 1857, Vol. III., p. 60, 1860. The Group *Actinaria* of Dana is here considered an order parallel with *Alcyonaria*.

7 Histoire Naturelle des Coralliaires, Vol. II, p. 4, 1857.

8 Revision of the Polyyps of the East Coast, U. S. in Memoires Boston Soc. Natural History, Vol. I, page 14, 1864.

9 These Proceedings, Vol. IV, p. 145, 1865.

often dividing into a cluster of short, obtuse branchlets. Lateral corallites, irregular in size and position, swollen below, smaller at the ends, appressed, turned in various directions, the summits often incurved; cells opening inward, small, usually showing six nearly equal septa. Terminal corallites not much exceeding some of the lateral ones in size, thick, obtuse, but little prominent; cells showing twelve septa, those of the second cycle much narrower than the rest. Surface of the cœnenchyma and exterior of the corallites loosely porous, covered by crowded lacerately divided granules or small spines, with numerous openings between them. Costæ scarcely apparent.

Color of unbleached coral, light brownish yellow.

Height of the only specimen collected 6 inches; length of branches 3; thickness about .25.

Loo Choo Islands. Dr. Wm. Stimpson.

MADREPORA HEBES Dana.

Specimens of a *Madrepora*, the locality of which is not certainly known, but supposed to have been collected at the Loo Choo Islands or Tahiti, are in the collection. These I am not able to distinguish from *Madrepora hebes* Dana, by comparison with his typical specimens from Tahiti.

MADREPORA NOBILIS Dana.

Fragments in alcohol.

Gaspar Straits. Capt. Stevens.

MADREPORA TERES Verrill, nov. sp.

Corallum arborescently branched. The branches long, round, slightly tapering, spreading at an angle of about 50°; branchlets slender, rapidly tapering, rounded at the end. Apical corallites small, scarcely prominent, with six septa well marked, and six rudimentary ones between. Lateral cells small, not crowded, arranged evenly on all sides; those towards the ends of the branches opening upward, and pro-

vided with a small ligulate border on the lower side; those on the larger branches opening outward, wholly immersed; the margins even with the surface of the branches. Cœnenchyma strongly vermiculate and sharply scabrous. Branches 6 or 8 inches long; .5 of inch in diameter; cells about .04.

Ousima. Dr. Wm. Stimpson.

This species is allied to *M. stigmataria* M. Edwards and Haime, and *M. virgata* Dana. The latter differs in having smaller and more crowded cells, which are throughout tubular and slightly prominent. The former differs in its mode of growth and the form of the corallites.

MADREPORA ARBUSCULA (?) Dana.

A fragment of a *Madrepora* closely allied to this species is in the collection, in alcohol. It is the summit of a round and rather slender branch, covered with prominent, tubular corallites, varying considerably in size, crowded and directed upward. The terminal ones are about twice as large as the lateral ones.

Kagosima Bay, Japan. Dr. Wm. Stimpson.

MADREPORA TUMIDA Verrill, nov. sp.

Corallum corymbose, the branches coalescing into a broad, massive base, supported by a thick peduncle, the upper surface flattened. Towards the margin the branches spread horizontally, and gradually become loosely coalescent and free; from the whole upper surface arise numerous nearly upright branchlets, which are rather stout, about two inches high, tapering rapidly, and mostly dividing into several small secondary branchlets. Lateral corallites large, thick and turgid, somewhat appressed, the cells large, opening upwards, conspicuously stellate with twelve septa, of which the secondary ones are much the narrowest; two of the primary ones, corresponding to the inner and outer sides of the cells, are broader than the rest, and reach nearly to the centre of the cells. Terminal corallites somewhat larger than the lateral, exsert, the margin thick, very porous;

cells with twelve septa, the six primary ones equal, the secondary well developed, about half as broad as the primary ones. The cells at the bases of the branches are wholly immersed, but have twelve conspicuous septa; on the lower surface there are very few cells; these are very small, and wholly immersed. Surface of the cœnenchyma openly reticulate and porous, with spinose granules; exterior of corallites densely covered with small, lacerate spines.

Breadth of largest specimen 18 inches; height from base 5.

Hong Kong, China. Dr. Wm. Stimpson.

This species is allied to *M. plantaginea* Lamarck. The latter has, however, shorter and more crowded corallites, with the exterior distinctly striated, and they are scarcely tumid at the base. The terminal ones are also much larger and thicker, giving an obtuse appearance to the branches.

MADREPORA PROLIXA Verrill, nov. sp.

Corallum diffusely branched, consisting of several diverging branches, which are divided into very numerous branchlets, forming densely branched clumps. Branchlets very proliferous, some of them consisting of several long, slender, often curved corallites, others are slender and elongated; terminal one surrounded below by several appressed tubular corallites, thus forming a slender, irregular branch. Corallites all slender, tubular, and much elongated, the terminal ones particularly so, often half an inch or more. Cells small, terminal, with six distinct septa. Surface of the cœnenchyma and exterior of the corallites evenly and crowdedly covered by delicate granulations, without distinct striations, but showing irregular pores in some places.

Height 6 inches; cells .02 of an inch in diameter.

Ousima. Dr. Wm. Stimpson.

This species closely resembles *M. longicyathus* Edw. and H. A typical specimen of the latter, sent by M. Edwards to the Museum of Comp. Zoölogy, with which I have had an opportunity of comparing this, differs in the structure of the cœnenchyma, which is penetrated by numerous linear pores, giving

it a vermicillated appearance, while it is covered with more scattered and pointed granulations, and the exterior of the corallites presents distinct sulcations, or rather linear series of granulations. The cells also are nearly twice as large and the texture of the coral much firmer than in the present species.

MADREPORA PUMILA Verrill, nov. sp.

Corallum low and spreading horizontally near the bottom, the branches spreading from one side of the coral. These are openly reticulated and occasionally coalescent, crooked, and irregular, flattened from above, giving off from the sides and upper surface short, irregular, scattered branchlets, many of them consisting only of a terminal cell, with one or two small lateral ones; others are slender and angular, an inch or more long, with a few distantly scattered and rather large lateral cells. Terminal corallites, somewhat exsert, thick, sub-conical, being thickened below. Cells with six septa and a thick margin. Lateral corallites few, tuberculiform, thickened at base with a simple tubular lip; cells but little smaller than the terminal ones, with six septa distinct. On the lower side of the coral there are neither cells nor branchlets. Coenenchyma very porous and open, spongiform, scabrous, without distinct striations even on the corallites.

Breadth of coral 5 inches; height 1.5; diameter of larger branches .28; of cells .05.

Bonin Islands. Dr. Wm. Stimpson.

MADREPORA GLOBICEPS (?) Dana.

A fragment from Groper Shoal, Coral Sea, south-east of Australia.

MADREPORA TUBICINARIA (?) Dana.

A *Madrepora* much broken, agreeing in many respects with this species, consists of a cluster of long and much subdivided branches arising from a thick massive base, form-

ing a convex cæspitose clump. The corallites are large, open, tubular, with the cells not appressed, opening upward, with the exterior evenly costate. The terminal corallites are but little larger than the lateral, somewhat exsert. The cells are all deep, with the star in most of them indistinct.

Tahiti. Dr. Wm. Stimpson.

MADREPORA STRIATA Verrill, nov. sp.

Corallium subarborescent; closely branched and much subdivided above, covered on all sides with crowded lateral branchlets, which are much smaller on one side of the trunk, indicating that the coral grew in an oblique or horizontal position. The branchlets on the lower side are numerous, about half an inch long, abruptly spreading, and consist of a cluster of several elongated, leading corallites, with a few smaller lateral ones. On the upper side, and towards the end, the branchlets become from one to two inches long, slender and much subdivided, the subdivisions always spreading at a large angle like the branchlets themselves. On all sides of the trunk and large branches immersed cells occur, of rather large size.

Terminal corallites elongated, tubular, considerably exsert, the exterior neatly costate, with pores between the ribs; walls but little thickened; cells but little larger than the lateral ones, deep, with twelve narrow septa. Lateral corallites large, open, tubuliform or somewhat cochleariform, opening upward, not crowded nor appressed, the exterior costate; the costæ with minute, short spines. Cells large, with a well marked star of six septa, and often with minute ones of the second cycle between; two of the principal septa meet at the middle. Coenenchyma very firm, with scattered, irregular pores, the surface minutely spinulose.

Height of the largest specimen 13 inches; diameter of trunk at base 1.5; diameter of lateral cells .08.

? Ousima, Japan. Dr. Wm. Stimpson.

This species branches somewhat like *M. carduus* and *M. rosaria* Dana, but the corallites are entirely different in form.

FAMILY, PORITIDÆ Dana.

PORITES TENUIS Verrill, nov. sp.

Corallum glomerate; globose, attached by a narrow base; surface irregular and uneven. Cells very small and shallow, crowded, polygonal. Walls thin and very porous. Septa twelve, imperfect, open trabicular. Pali five or six, well developed. Columella very small, tubercular.

Diameter of the largest specimen collected 2.5 inches; of cells .05.

Loo Choo Islands? Dr. Wm. Stimpson.

PORITES sp.

A small specimen of a glomerate species, too young for specific description, is in the collection.

The cells are polygonal, rather deep, with twelve well developed septa and six strong pali forming a circle around the deep, open, central space in which there is no columella visible. Walls well developed, angular, acute.

Diameter of the cells .06.

Hong Kong, China. Dr. Wm. Stimpson.

The well developed walls and pali, and the absence of columella cause this species to approach closely to *Rhodaraea*, to which it may hereafter be necessary to refer it when more complete specimens are obtained. It has, however, but two cycles of septa instead of three found in the typical species of that genus.

MONTIPORA FOLIOSA? Edw. and Haime.

A frond-like branch about seven inches high and having a width near the top, where it is thin and has the sides curved inward, of about four inches. The basal portion is a stout stalk, convex externally and concave within, dead below, and curving outwardly so that the flat part of the frond has an oblique position. The upper or inner surface is densely covered by rather large, angular, very irregular and unequal prominences, which often unite into longitudinal crests of

some length, but very irregular in form. The cells are very small and inconspicuous among the tubercles. On the exterior the surface is but little tubercular and the cells are larger, more regular and somewhat prominent with twelve septa, of which six are very small.

Gaspar Straits. Capt. John Rodgers.

MONTIPORA PORITIFORMIS Verrill, nov. sp.

Corallum branched, forming clumps of round, crooked, proliferous branches often digitate at the ends. Surface without prominences, even, very porous. Cells regularly and rather closely arranged, small, even with the surface, or, occasionally, surrounded by a slight elevation, having six well developed and nearly equal septa, with sometimes other rudimentary ones between. Cœnenchyma finely echinulated with crowded, lacerate granules.

Height five inches; diameter of branches .35; of cells .03. Loo Choo Islands. Dr. Wm. Stimpson.

This species is allied to *M. tortuosa* and *M. digitata*, but has larger and more crowded cells than either, with coarser and more irregular branches, and the cœnenchyma is more loose and porous.

These three species would appear worthy of being separated generically from the typical, tuberculated species were it not for the fact that even those often present, at the base and on foliaceous expansions, cells which are not accompanied by any tubercles or other prominences.

MONTIPORA RIGIDA Verrill, nov. sp.

Corallum branched, the branches strongly compressed, thin at the summits, forming flattened clusters of branchlets coalescent below. Cells small, situated at the bottom of larger cell-like depressions formed by thin, angular elevations of the cœnenchyma between and around all the calicles, giving the surface the appearance of some madrepores with short open corallites. The septa are imperfectly developed, six in number, trabicular and spinose, cœnenchyma firmer

than usual for the genus, uneven, strongly echinulated, pierced by numerous rounded pores.

Height of fragments three inches; branches near the end half an inch broad and less than a quarter of an inch thick; diameter of cells about .03 of an inch. Color dull yellowish brown.

Bonin Islands. Dr. Wm. Stimpson.

PSAMMOCORA PARVISTELLA Verrill, nov. sp.

Corallum consisting of clusters of short, irregular, compressed, clavate branches, somewhat coalescent, and mostly having obtuse crest-like projections near the ends. Cells very small, shallow, with often a minute tubercle at the bottom. Septa six, thick, triangular, lacerately granulous, separated externally only by six very narrow spaces, which gradually are confounded with the porous tissue of the cœnenchyma, there being no apparent walls to the cells. The surface between the cells, which are distantly scattered, is evenly and densely covered by minute lacerate granulations or papillæ, with reticulated narrow spaces between. Color of dry coral light yellowish brown.

Height 2 inches; length of branchlets .5; diameter of cells about .01; distance between them .04.

Loo Choo Islands. Dr. Wm. Stimpson.

FAMILY, GEMMIPORIDÆ.

TURBINARIA SINENSIS Verrill, nov. sp.

Corallum crateriform, growing to a large size, thick and firm, attached by a short, thick peduncle. Corallites moderately large, rather crowded, arranged somewhat in transverse or concentric series, standing, except near the edge, almost perpendicularly to the surface, projecting but little above the surface of the cœnenchyma, somewhat swollen at base. Cells very deep with the columella very much reduced, septa subequal, narrow, in three cycles, some of the third wanting, except in a few larger cells where some of the fourth appear. Cœnenchyma between the cells loosely porous and

spongy. Surface beneath, even, uniformly covered with loose irregular papillæ, with large, irregular pores between, producing a spongy appearance.

Height of a large specimen 10 inches; width 14; thickness 1 inch from edge .3; diameter of medium sized cells .09. This is a much thicker and firmer species than *T. cinerascens* which it resembles. It has deeper, more crowded, and less prominent cells, which are placed less obliquely. The lower surface does not present undulations corresponding to the corallites near the edge, due to the thinness of the coral.

TURBINARIA sp.

A fragment, too imperfect for identification, of an encrusting species. Corallites tumid at the base about a line in diameter and elevated nearly as much above the cœnenchyma, which is strongly granulated.

Coral Sea. Dr. Wm. Stimpson.

FAMILY, EUPSAMMIDÆ Edw. and Haime.

BALANOPHYLLIA CAPENSIS Verrill, these Proceedings Vol. IV, p. 149.

Plate 1, figure 1; Plate 2, figure 1, 1^a.

Corallum turbinated, enlarging gradually from near the base which is broadly attached. Epithea well developed rising to within about an eighth of an inch of the summit; above this the wall is very porous and openly granular with deep intercostal furrows. Calicle deep, broadly oval, the depth more than half the greater diameter. Septa in four cycles, the primaries and secondaries considerably exsert, within nearly vertical, with entire inner edges, somewhat falcate and narrowed near the top, where they become granulated, porous and finely toothed, those of the third cycle very narrow and small; those of the fourth cycle well developed, very thin and porous with jagged edges, the two in each half system meeting each other near the columella, to which they extend. Columella formed by a group of styli-form processes.

Color of living polyp bright vermilion. Tentacles twenty, short and blunt, those of the first cycle longest. Mouth oblong.

Simon's Bay, Cape of Good Hope, in 15 to 20 fathoms, rocky bottom. Dr. Wm. Stimpson.

EUPSAMMIA STIMPSONIANA Verrill, these Proceedings, Vol. IV, page 150, 1865.

Plate 2, figures 3, 3^a

Coral elongated, slightly compressed, obconical, the base in the younger specimen having been adherent, in the larger one smoothly rounded. Walls closely costate to the base, the costæ slightly wavy, minutely scabrous. Cup in the larger specimen regularly oval, narrow and deep. Columella well developed, salient in the form of a flattened tubercle, septa in four cycles with a few rudimentary ones of the fifth, those of the first two cycles broad, evenly arched to the summit, a little exsert, the edges entire. In the younger specimen the cell is nearly circular and the septa of the fourth cycle are rudimentary.

Length of larger specimen 1.25 inch; cell .62 by .48; depth .36; young, length .75; diameter of cell .27.

North China Sea, 25 fathoms, shelly sand. Dr. Wm. Stimpson.

DENDROPHYLLIA GRACILIS Edw. and Haime.

Plate 1, figure 2; Plate 2, figures 2, 2^a

A fine series of this elegant species is in the collection. The columella is usually more prominent than indicated by Edwards and Haime, and the manner of budding is quite variable. The first and second cycles of tentacles are larger than the rest, mouth oval with well marked lateral folds.

Color bright salmon, tentacles almost white, mouth white, disk radiated with salmon color.

Near Hong Kong, in 25 fathoms, gravel, and in several other localities at various depths in muddy gravel. Dr. Wm. Stimpson.

DENDROPHYLLIA CECILLIANA Edw. and Haime.

Loo Choo Islands. Dr. Wm. Stimpson.

PACHYSAMMIA, nov. gen.

Corallum massive and incrusting, consisting of several corallites united together near their summits by a massive cœnenchyma, budding lateral, irregular, surface of the cœnenchyma with waving ribs as in *Dendrophyllia*. Four complete cycles of septa. Columella not salient, rudimentary or trabicular.

This genus approaches *Stereopsammia* but has a solid cœnenchyma. It differs from *Dendrophyllia* in not having a distinct columella.

PACHYSAMMIA VALIDA Verrill, nov. sp.

Corallum broadly adherent at base, consisting of several corallites united together at their bases by the thickened cœnenchyma, their summits free to a considerable extent. The surface is strongly ribbed by coarse, granulous, waving costæ united together frequently by trabiculæ, leaving irregular spaces between. Cells large, deep, oblong-oval with thin porous walls. Columella little developed, loose trabicular; septa in five cycles, those of the two first subequal, rather broad, thick, the edges entire, and sides strongly granulated, not exsert; those of the third and fourth much narrower; those of the fifth more developed than the fourth, united together in pairs and to the inner edges of those of the preceding cycle before reaching the columella, with which their inner edges are confounded.

Height of the only specimen .75; greatest diameter of cell .48; width .3.

Hong Kong, China. Dr. Wm. Stimpson.

CÆNOPSAMMIA MANNI Verrill, nov. sp.

Corallum encrusting rocks, forming clusters of crowded cups, about an inch high, some of the corallites are laterally united even to the top, others are separated about an eighth

of an inch and rise nearly a quarter of an inch above the coenenchyma. The exterior of the corallites is obscurely and closely costate, and covered closely with rough granulations. Septa in four cycles, the last imperfectly developed. Primaries much thicker than the others, very narrow at the top and not projecting above the wall, which is much thickened, on their inner edges slightly concave, and increasing somewhat in width toward the bottom of the cell, where they join the columella. The secondaries are still narrower and thinner, but also join the columella. Those of the third order are extremely narrow and often do not reach the margin of the wall, and do not join the columella. Those of the fourth order are merely slightly raised costæ, very thin and uneven. Columella well developed, spongy, nearly half as broad as the cell.

Cells slightly oval, the larger ones about .35 of an inch in diameter, and nearly the same in depth.

Color of living polyps vermillion red.

Sandwich Islands, at low water mark. Horace Mann.

It is with pleasure that I name this species in honor of its discoverer, Mr. Horace Mann, a young man of unusual ability and industry, who made many important botanical discoveries, during his explorations in the Sandwich Islands.

SUBORDER, ASTRÆACEA.

FAMILY, LITHOPHYLLIDÆ.

MUSSA GRANDIS Edw. and Haime. (?)

A worn specimen allied to this species. It has, however, some of the polyps united into series of three or four and others simple but deformed, these are 1.25 inches or more in diameter. Columella well developed spongy. Walls sparingly spinose.

Coral Sea, East of Australia. Dr. Wm. Stimpson.

FAMILY, MÆANDRINIDÆ.

GONIASTREA ASPERA Verrill, nov. sp.

Corallum evenly convex, or hemispherical, adherent at the centre below, with a well developed epitheca which is marked by uneven, concentric ridges. Cells deep, polygonal, pretty regular, separated by very thin walls. Septa with prominent and strong, but narrow, pali at base, above narrow and thin, a little exsert, acute at summit, the edges divided into slender and very acute teeth which are directed upward. Columella rudimentary, trabicular.

Diameter of the cells .30; depth .20 of an inch.

Hong Kong, China. Dr. Wm. Stimpson.

CÆLORIA SINENSIS Edw. and Haime.

Hong Kong, China. Dr. Wm. Stimpson.

CÆLASTREA, nov. gen.

Corallum massive, cellular, fasciculate, formed by prismatic coralites intimately united by their walls which are thin and simple. The exterior of the corallum is destitute of an epitheca, lobed and distinctly costate like that of *Metastrea*. The cells are polygonal, often closed below by the dissepiments, which, occurring at the same level, unite from all sides forming thus transverse septa. In a transverse section traces of a very rudimentary and loose columella are seen in some cells. Septa in three or four cycles, unequal, the inner edges prolonged into strong paliform teeth.

The polyps increase by fissiparity, and near the margin by disk-budding. This genus appears to bear the same relation to *Goniastrea* that *Metastrea* does to *Prionastrea*, differing from it in the absence of epitheca and the lobed and striated exterior, thinness of the walls, and rudimentary columella. From *Metastrea* it differs in the last character, and in its mode of increase as well as in the coincidence of the dissepiments and the strong pali.

CELASTREA TENUIS Verrill, nov.

Corallum somewhat columnar or turbinate, flat at top, attached by a narrow base; the sides are marked by lobes corresponding to the marginal corallites, and striated even to the base; the ribs a little prominent, finely echinate near the cells. Cells unequal, irregularly polygonal, mostly closed by a complete floor below. Walls very thin, forming a zigzag line between the septa. Septa very narrow, thin, finely serrate, the inner edges perpendicular, little exsert, not crowded, in four cycles, the last often incomplete. Pali prominent, wide, and thicker than the septa, situated before all the cycles except the last. Columella not apparent except in a section, where it appears very rudimentary. Dissepiments horizontal, about a tenth of an inch apart, mostly coincident, so as to form complete transverse floors.

Height 2 inches; diameter 3; the average width of cells .2.

Sandwich Islands? Prof. J. D. Dana. U. S. Expl. Exp.

ASTREA (FAVIA) HOMBRONI Edw. and Haime. (?)

Corallum incrusting at base; the surface, where free, naked and striated, rising at center into a convex, lobed mass. At the margin and about the base the cells are oval or circular, and separated by a space equal to their own diameter, while at the top they become crowded, polygonal, and intimately united by thin walls. Cells of medium size, rather deeper than wide, with about 18 septa in three cycles, the last incomplete in part of the systems. Septa narrow, considerably exsert, acute at summit, toothed with small sharp spines, a little thickened at the walls, not crowded. Paliform teeth, prominent, slender, placed before the two first cycles. Columella well developed, spongy. Costæ, where the cells are separated, thick and prominent, scabrous. Exotheca compact.

Height of coral 4 inches; diameter about the same; width of cells .12.

Sandwich Islands (?) Prof. J. D. Dana.

In "box 820," with *Montipora capitata*, *Porites lobata*, *Celeastrea tenuis*, *Favia rudis*, *Pocillopora*. (Coll. Smithsonian Institution).

ASTREA (FAVIA) RUDIS Verrill, nov.

Corallum massive, convex or hemispherical, cellular. Corallites a little prominent, oval or oblong, unequal, rather close together at the margin, crowded at the center, with concave interstices striated by the thin, salient costæ. Cells deep, conical, with three cycles of septa, which are narrow, thin within but strongly thickened near the walls, considerably exsert, the upper part divided into strong spinose teeth, the inner edges with more slender sharp ones; paliform teeth little marked. Columella fine, spongy.

Diameter of coral five inches; of largest cells .38; depth about as much.

Sandwich Islands (?) Prof. J. D. Dana.

ASTREA (FAVIA) ORDINATA Verrill, nov.

Corallum evenly convex, or hemispherical, incrusting below. Corallites projecting considerably above the surface, scarcely crowded; the interstices concave, evenly ribbed by the prominent, denticulate costæ. Cells large, open and deep, subcircular or oval, pretty regular. Septa in three complete cycles, with some members of the fourth, amounting usually to from 30 to 36, all of them nearly equal and remarkably even in their appearance, narrow within the cells, with strong paliform lobes at the base, but broader and regularly rounded at the top, appearing slightly revolute, moderately thick, evenly serrate, with small teeth. Columella little developed.

Diameter of a small specimen 2.25 inches; thickness at centre .75; length of cell .38; width .26; depth .24.

Hong Kong, China. Dr. Wm. Stimpson.

This species is closely allied to *A. speciosa* Dana, from Singapore, but differs in several important particulars from the original specimens of that species.

PRIONASTREA CHINENSIS Verrill, nov.

Corallum broad, explanate, somewhat convex above and with irregular protuberances; below incrusting at the center, at the edges unattached and covered by a complete epitheca strongly marked with concentric lines of growth, and extending to the edges. Thickness of coral about half an inch, becoming as thin as .08 near the margin. Cells about .35 of an inch in diameter, rather shallow, less deep than wide, center depressed much the lowest, and having a papillose columella composed of from six to twenty slender teeth-like processes; paliform teeth well marked, making a prominent circle around the central space, rather stout and lacerate at the ends. Septa about 32 or 34 in number, subequal, except some small ones of the last cycle, not crowded, narrowed within and deeply serrate with numerous spine-like teeth, which are themselves often lacerate, or divided at the ends into several slender, sharp teeth. Paliform teeth much larger and stronger than the rest. Walls for the most part thick and rounded; on the protuberances often simple, thin and compact.

Color of the unbleached coral deep yellowish-brown.

Hong Kong. Dr. Wm. Stimpson.

PLESIASTREA INDURATA Verrill, nov.

Plate 2, figure 7.

Corallum broadly incrusting, convex above. Corallites oblong, oval and irregular in form and size, scarcely prominent above the general surface, rather crowded. Cells deep and narrow. Columella loose, spongy. Paliform lobes, slender and prominent, but scarcely visible except in a vertical section. Septa in four complete cycles, perpendicular within, broad and rounded at the summit, evenly and finely denticulate, thick and closely crowded, scarcely exsert, those of the last two cycles much narrower than the others. Costæ prominent, very thick, those of adjoining corallites often coalescing. Interstitial spaces nearly flat. The buds appear irregularly between the cells.

Breadth of the largest specimen 3 in.; thickness .50; Average length of cells .25; depth about as much.

Loo Choo Islands. Dr. Wm. Stimpson.

In a vertical section the walls appear very compact and solid, and those of adjacent cells are so closely united as to leave only a few small, irregular cells between; the endothecal plates are very thin, strongly inclined downward and inward, distant about .03 of an inch, but somewhat irregular; the sides of the septa are strongly granulated; columella firm, but coarsely trabicular.

Some of the cells seem to produce submarginal buds thus approaching *Baryastrea*. In general appearance this species resembles *Dichocenia*, but the character of its denticulate septa forbids its being placed there.

Plesiastrea urvillei Edw. and Haime.

A fragment, apparently of this species, is preserved in alcohol. In some of the cells there are four full cycles of septa, but in most of them there are but three cycles with a few of the fourth slightly developed; some cells seem to have divided by fissiparity as in *Favia*. The polyps, as contracted, show a broad oval mouth within the circle of prominent pali; and the tentacles, contracted to mere tubercles, are outside of the pali. Over the surface of the coral the membrane is very thin. In a section the ovaries are seen to fill the spaces between the septa, down to the first transverse dissepiments.

Port Jackson, Australia. Dr. Wm. Stimpson.

Leptastrea stellulata Verrill, nov.

Corallum convex, incrusting, with irregular prominences, lower surface, where free, covered with a thin epitheca. Cells large, often .25 inch, with many small ones between them, which are usually considerably exsert, and arise by lateral or marginal budding. Septa in four cycles, broad, with truncate, nearly entire summits, but finely denticulate below. The six primary septa are the largest, and thick-

ened towards the centre of the cell. The others coalesce at their inner edges. Costæ much thickened, but scarcely prominent above the surface of the interstitial spaces. Texture very compact.

Sandwich Islands. Yale College Museum.

CYPHASTREA OCELLINA Edw. and Haime.

Astrea ocellina Dana, Zoöph.

This species belongs truly to *Cyphastrea*, where Edwards and Haime have placed it with doubt. .

Sandwich Islands. Yale College Museum.

ALLOPORA CALIFORNICA Verrill, nov.

Corallum encrusting at base, rising into thick, irregularly lobed or palmate branches, three inches or more high, some of which are two inches broad, and nearly half an inch thick; others nearly round and rapidly tapering, of about the same thickness as the others. Many of the branches have annelid tubes in the center, and appear to be due to the encrusting habit of the coral, which covers the tubes with a thickness of from an eighth to a fourth of an inch, and in this way may rise into false branches. Some of the branches subdivide into two or three parts near the end, which spread nearly at right angles. Cells very small, .02 inch, quite regularly scattered over the whole surface; distance between them equal to two or three times their diameter, or from .04 to .07 of an inch. Intercellular tissue compact, with a minutely granular surface, appearing smooth to the unaided eye, but having a few minute papillæ between the cells. In a longitudinal section the cells are seen to be filled up below, and between them there are irregularly scattered, minute, rounded cavities, caused by the superficial papillæ or vesicles. Septa represented commonly by six thick triangular processes which converge toward the center of the cells, leaving only narrow, radiating spaces between them; in other cells the number varies from five to eight. The septa project slightly above the common surface, and do not reach more than half way to the center of

the cell, which is open and deep, having a minute conical columella at the bottom, usually visible only in a section.

Color light minium red.

California, in deep water. Mr. Rich. Collection Yale College Museum.

This is an interesting representative of a genus, hitherto but little known; the original species described by Ehrenberg (*Allopora Oculina*) being represented only by a single specimen from an unknown locality.

The genus is quite distinct from *Stylaster* and *Distichopora*,* to both of which it is nearly allied. From the former it differs in the scattered arrangement of the cells and the small number of septa, as well as in mode of growth and other characters.

CYCLOPORA genus nov.

Corallum branching in a plane. Cells open and deep, arranged in series on the sides of the branches, with two cycles of septa more or less complete, without an apparent columella. Septa united together by their inner edges, so as to form a ring surrounding the central space and cutting off the interseptal chambers.

This genus is intermediate between *Stylaster* and *Distichopora* in the structure of its septal system, but has more open cells than either.

Type *Cyclopora bella* Verrill. *Allopora bella* Dana, Zoöph. page 696. Plate 60, fig. 6.

FAMILY, EUSMILLIDÆ.

EUPHYLLIA UNDULATA Verrill, nov.

Corallum forming open clumps, of rather long, angular, irregular, often bent and compressed branches, the corallites dividing rapidly and generally completely, and diverging at a large angle. Exterior irregularly costate to near the base, the costæ very unequal and little prominent except near the

* For comparison of *Stylaster* and *Distichopora* see Bulletin Mus. Comp. Zoölogy, No. 3, by A. E. Verrill, page 46. Cambridge, 1864.

edge of the cells where the principal ones are thin and somewhat salient, forming at intervals short crests. The branches and corallites are surrounded by transverse ridges or wrinkles at irregular intervals. These are unequal in size and not very prominent, giving an undulated appearance to the surface. In the axils between adjacent corallites the edges of the branches are strongly compressed, thin and often acute.

The cells are irregular and contorted, mostly simple, with a narrow and deep central space. Septa in five cycles very unequal, thin, not crowded, the primary ones nearly meeting at the centre, the inner edges nearly perpendicular, summits obtusely rounded, scarcely exsert. Walls very thin and compact.

Height six inches; diameter of cells .5 to .75.

Bonin Islands. Dr. Wm. Stimpson.

This is nearest to *E. striata* E. and H. It has larger and less open cells, and less regular costal striations. It also branches in a different manner.

GALAXEA FASCICULARIS Oken (?)

A *Galaxea* closely allied to or identical with this species, occurs in the collection, represented by only one specimen. Although differing in some points from the present species, under which Edwards and Haime unite several species, considered distinct by others, I do not deem it justifiable to separate it without more specimens, for the species of this genus are quite variable, and the differences are not well marked, in the dry corals, at least.

The corallites are united to within half an inch or less of their summits by a rather loose peritheca, having numerous dense layers at intervals of about one fourth of an inch. The mass is somewhat convex above, and about two inches thick. The Corallites are mostly cylindrical above the peritheca, except the young ones which are turbinate, many are compressed or somewhat irregular where crowded. The wall is nearly smooth, with costæ prominent and crest-like close to the summit, but indicated below by mere striæ, septa very prominent in three cycles, those of the two first

nearly equal, the rest quite small, not projecting to one fourth the height of the others. The large ones are narrow, thickened, especially in the middle, concave on their inner edges, obliquely truncate at top where they are slightly, and irregularly denticulate. The outer edge is mostly nearly straight and finely denticulate. Cells deep and without a columella.

Diameter of the largest cells .2 of an inch. Color of coral light yellowish brown.

Loo Choo Islands. Dr. Wm. Stimpson.

FAMILY, TURBINOLIDÆ Edw. and Haime.

PARACYATHUS PORCELLANA Verrill, nov.

Corallum low, smallest below the middle, slightly enlarging towards the top; base broadly attached; calicle broad, oval, deep, the edges most elevated in the transverse diameter. Septa in four cycles with some belonging to the fifth in part of the systems, the primaries considerably exsert, with the other successively less so, all of them having the sides strongly granulated; inner edges of the principal ones abruptly descending from the rounded ends. Columella loosely papillose, formed by a few prominent, slender, styli-form teeth; pali numerous, the inner ones similar in appearance to the columella, but all appearing as slender teeth along the edges of the septa; costæ nearly equal, broad and but little prominent; the grooves between them fine but well marked. External surface minutely granulated.

Dredged at Hong Kong, China, attached to shells. Dr. Wm. Stimpson.

PARACYATHUS EBONENSIS Verrill, nov.

Corallum broadly adherent with the base wider than the cup, which is subcircular with a slight tendency to an hexagonal outline, moderately deep with a narrow central area. Wall thin at summit, evenly costate, the costæ low and thickened, surface finely granulated; towards the base there is a thin epitheca, which rises within a tenth of an inch of the

summit, and in young specimens reaches the margin. Septa in four cycles not crowded, diminishing in width and thickness according to their orders, projecting somewhat above the walls, broadly rounded at top and nearly perpendicular within, the primaries reaching about half way to the center; the secondaries little narrower, the surface of all strongly granulated. In front of all the septa, except those of the fourth cycle, there are prominent, thin, rather broad, and usually undulated, paliform lobes. Columella small, sunken, composed of about twenty papillæ.

Height of largest specimen .2 inches; diameter of cup .18; depth .1.

Ebon Island, on *Stylaster elegans* nob. H. Mann.

Young specimens .15 inch in diameter have a complete epitheca, septa not projecting, toothed and not rounded at summit, pali more slender, and columella relatively more developed.

HETEROCYATHUS ALTERNATA Verrill, these Proceedings, vol. iv, page 149, April, 1865.

Plate 2, figures 6 and 6 a.

Base attached to a small univalve shell, which it entirely covers and nearly conceals, forming thus a broad, flattened base more than half the diameter of the disk; above the basal region, which is covered with small granules and scarcely costate, there is a slight constriction, beyond which the walls spread obliquely outward to the edge of the disk; this part of the wall is strongly costate, the costæ being alternately very unequal, much thickened and strongly granulated. Septa in four cycles; those of the first broad and considerably exsert, with the upper edges evenly rounded and entire, inner border perpendicular, sides strongly granulated; those of the second cycle are nearly as broad and similar in form; those of the third and fourth cycles successively narrower. Paliform teeth exsert before all the cycles except the last, but are largest before those of the second. Columella very little developed, papillose, scarcely

prominent above the surface of the broad, shallow, central fossette. Diameter .35 of an inch; height .20.

Gaspar Straits. Capt. John Rodgers.

FLABELLUM, sp.

Plate 2, figure 5.

A single specimen imperfectly preserved, about half an inch high, and about the same in breadth, attached by a large pedicle with a slightly prolonged spinous process at each edge, close to the base. Outline of calicle ellipsoidal, the edges depressed in the line of the longest axis a very little, deep at the center. Relation of the axes as 1 to $2\frac{1}{2}$. Exterior with wrinkles or undulations running around it horizontally.

Locality unknown. Dr. Wm. Stimpson.

SUBORDER, FUNGACEA.

FAMILY, FUNGIDÆ.

FUNGIA PAPILLOSA Verrill, nov.

Corallum nearly circular, a little broader in the direction of the mouth than across it; elevated at the center, rather thick and massive, the edges evenly rounded, below nearly flat, densely covered by sharp, moderately elongated, conical spines, which are nearly uniform in size, except at the center, where they are somewhat smaller, but still crowded. Central fosse short, narrow, very deep. Columella rudimentary. Septa thick, sharp-edged, nearly uniform in width, closely crowded, perpendicular at the inner edge, rounded at summit, beyond which they are finely and sharply serrate; smaller ones with well marked tentacular teeth. Costæ crowded, subequal, densely papillose with conical spines.

Greater diameter 5.25 inches; lesser .5; thickness at middle 1.5.

Loo Choo Islands. Dr. Wm. Stimpson.

This is a well marked species, somewhat allied to *F. dentata* Dana, but quite different in the closely papillose character of the lower surface, and the thick, crowded and very finely serrate septa.

FUNGIA LACERA Verrill.

F. echinata (pars) Dana, Zoöphytes.

Fosette small; columella fine trabicular; principal septa rising perpendicularly; these are but little rounded above, and are lacerately divided into long, sharp, spine-like teeth, nearly from the inner edge. The septa are crowded, all except those of the last cycle, subequal in height, rather thick, strongly granulated on the sides, toothed in a similar manner. The later ones have a well marked tentacular lobe, which rises abruptly, inclining outward at an angle of 45°. The lower surface is strongly costate, with deep grooves and openings between the costæ, which are subequal, and, except those of the last two cycles, covered with long, sharp and acute spines, even to the center.

Diameter 6 inches, thickness 1.25.

Fejee Islands. J. D. Dana. U. S. Expl. Exp.

Differs from *F. Dana* in the less unequal septa, which are thicker, far more crowded, much more strongly toothed, and less rounded and more perpendicular at the inner edge. The tentacular tooth is more strongly marked. The lower surface is more numerous and strongly costate and spinose, and the costæ are less unequal. Some of these differences were mentioned by Prof. Dana. A comparison of his original specimens with a large number of *F. Dana* (*F. echinata* Dana) from Singapore has caused me to consider the two forms distinct.

FUNGIA, sp.

Two specimens of a *Fungia*, too young for identification, have a remarkably compact wall, closely costate, except near the center. The form is broad, turbinate, the margin of the wall inclining upward and producing a broad cup, shaped coral, the largest two and a half inches across the

longer diameter, and having a basal attachment a quarter of an inch across. The upper surface is irregularly oval; central fossette oblong, very deep; septa thick, finely toothed, Locality doubtful. Dr. Wm. Stimpson.

CTENACTIS (Agassiz, MS.) Verrill, Bulletin Museum of Comparative Zoölogy.

A very young specimen of an undetermined species, about one and a half inches in diameter, attached below for about a quarter of an inch, with a very thin, compact wall, spreading horizontally, with thin, rather distant and finely dentate costæ. Upper surface broad oval. Septa very thin, the six primaries prominent, inner edge perpendicular, and, like all the rest, with long, irregular, often lacerate teeth, the one nearest the inner edge broader and paliform. In the lateral systems there are but five cycles of septa, the fifth rudimentary, but in those of the ends there are representatives of seven cycles.

Japan. Dr. Wm. Stimpson.

FAMILY, LOPHOSERIDÆ Edw. and Haime, emend.

PAVONIA POLIOSA Verrill, nov.

A species growing in clumps of thin, contorted, crispate plates, which are loosely coalescent throughout; surfaces of the plates carinated or cristate near the edges, which are thin and acute. Cells small, shallow and open, not crowded, .2 to .3 of an inch distant. Septa in two cycles, with members of a third cycle in some systems; larger septa about ten, narrow, thin, with the sides strongly granulated, alternating with these are other very delicate ones. Columella rudimentary.

Color of unbleached corals light yellowish brown; height four inches; average thickness of plates .1.

Ousima or Loo Choo Islands. Dr. Wm. Stimpson.

This species is allied to *P. frondifera* from Singapore, but is more delicate, with thinner and smaller plates, and with much smaller, more shallow and open, and less crowded cells.

PAVONIA COMPLANATA Verrill, nov.

The single specimen of this species consists of a broad plate a quarter of an inch thick, attached at one side, with cells on both surfaces. From the upper side arise in oblique and irregular positions several broad, rounded plates, with sharp edges and nearly even surfaces, without carinations or crests. The plates are two or three inches broad, thick below, often curved and somewhat coalescent. Cells moderately large, deep, not crowded, from .1 to .2 of an inch distant. Principal septa about twelve, evenly rounded, thickened within the cells, narrow and thin between them, appearing distant, owing to the delicacy of the smaller septa which alternate with them. Columella a small, solid tubercle.

Color deep yellowish brown.

Loo Choo Islands. Dr. Wm. Stimpson.

Resembles *P. loculata** most, but besides its different mode of growth, it has much more open and less crowded cells, with larger columella and narrower septa, which are much thinner, more unequal, and less conspicuous between the cells. The texture of the coral is also more dense.

PACHYSERIS MONTICULOSA Verrill.

Aguricia rugosa Dana (non Lamarck).

This species is about .7 of an inch thick below, and about .4 in the middle. The ridges are very irregular in width and height, rising at irregular intervals into conical and oval prominences, often .25 of an inch or more high. The ridges are invariably rounded and obtuse, even where they rise into crests, differing widely in this respect from those of *P. rugosa*, which M. Edwards describes as acute. The septo-costal plates are alternately unequal, slightly crispate at the middle of the ridges, strongly granulated on the sides. The striae of the lower surface are prominent, moderately close, scabrous.

* The genus *Pavonia* was established by Lamarck in 1801, and consequently precedes its use in Entomology in 1816, on account of which Edwards and Haime rejected it.

Fejee Islands. Prof. J. D. Dana, U. S. Expl. Exp. Coll. Smithsonian Institution.

STEPHANOSERIS LAMELLOSA Verrill, nov.

Plate 2, figures 4 and 4a.

Corallum low, subcylindrical, with a very broad incrusting base, which is attached to, and entirely surrounds small univalve shells, with the exception of the opening. The incrusting matter on remote parts of the shell often consists of small conical granulations much crowded and arranged in rows, near the walls these pass into costæ, which are very thick, prominent and granulated at the base, thinner above, those of three first cycles much the strongest and thickest, subequal; those of the fourth, which alternate with them, distinct and prominent, but thin, spongy and lacerately toothed, disappearing much sooner towards the base than the others. Wall rudimentary, represented near the margin only by trabicular processes.

Septa in four cycles, thin, strongly granulated, the primaries much the broadest, and most exsert, with subentire, rounded tops, and vertical inner edges; those of the other cycles, thinner and very narrow, exsert, with the edges lacerate, those of the fourth cycle broader than those of the third; occasionally in large specimens some rudimentary septa of the fifth cycle appears. Columella well developed, papillose, not distinguishable from the innermost pali, several of which rise as slender, styliform, toothed processes from the base of each septum, those from the primaries the largest.

Height .1 to .2 of an inch; diameter of cup .2 to .25.

Loo Choo Islands in 8 fathoms, sand. Dr. Wm. Stimpson.

In very young specimens the base spreads but very little on the shell, which is quite naked beyond the termination of the costæ. The wall is entirely rudimentary, causing the costæ to appear very prominent; the septa project but little above the columella, and the surface of the coral is nearly flat on account of the absence of a wall to the cup. The

septa and columella are comparatively well developed, and constitute the entire structure of the coral.

STEPHANOSERIS JAPONICA Verrill, nov.

Corallum low, covering small, univalve shells, like the other species of the genus, somewhat wider at the summit than at the base, with a broad, oval, nearly circular cup. Costæ 48 in number, alternately larger and smaller; those of the first three cycles quite prominent, thickened towards the base, evenly dentate, or strongly granulate along their whole length; the granules or teeth often in two or three rows towards the base, where the costæ are thickened. The costæ of the fourth cycle are much less developed, little prominent, with the edges covered by strong, sharp granulations. Away from the base of the coral the shell is covered with rows of sharp, conical granulations which become scattered towards its tip and beneath. In one specimen a young coral rises from this granulated extension of the base, near the point of the shell, apparently by budding. Septa in four cycles, those of the third least developed; those of the first and second cycles very prominent, with rounded summits, and inner edges perpendicular, finely denticulate at the top, but having several strong paliform teeth at the inner base; the septa of the fourth cycle are united in pairs to the primaries and secondaries, at their outer edges, and rise nearly as high, though much narrower and thinner, and thus are formed prominent clusters of three septa, alternating with single septa of the third cycle, which are narrow and little prominent. Collumella less developed than in the preceding species, of a fine spongy texture, occupying about a fourth of the width of the cup. Diameter of the largest specimen .25 of an inch; height above the shell .15; depth of cup .08; projection of primaries .05.

Kagosima, Japan, in 20 fathoms. Dr. Wm. Stimpson.

This species resembles *S. lamellosa* in form, but may readily be distinguished by the more strongly toothed and rougher costæ, those of the fourth cycle not being so thin and prominent; the principal septa more prominent and wider; the columella much finer, less developed, and scarcely

papillose; the pali less prominent; the cup deeper, etc. A specimen preserved in alcohol shows a distinct, transparent membrane over the whole wall, and covering with a somewhat inflated fold each of the costæ which are visible through it. At the edge of the cup the wall membrane presents a distinct angle, where it joins the disk. The mouth is a large oval opening, with an apparently simple margin. The tentacles are not apparent.

All the specimens that I have seen of the three species here described are on small univalve shells, which are occupied by *Sipunculus* or some similar worm, which maintains only a small round hole at the mouth of the shell; all other parts, except occasionally the tip of the spire, being covered by the coral. But young specimens do not spread on the shell beyond the basal attachment, and the shell is inhabited by the same worm, with a similar hole; the remaining portion of the mouth of the shell being closed by particles of agglutinated sand, &c., thus proving that the corals grow gradually over this portion, like the surface of the shell itself.

STEPHANOSERIS SULCATA Verrill, nov.

This species differs from the others in having thin and very prominent costæ, which are dentate along the edges and scarcely granulated; those corresponding to the last cycle being represented only by rows of sharp teeth. The principal costæ are separated by rather broad, concave sulcations. The wall is well developed, thin and compact. The septa are less crowded than in the other species, and have their sides not so strongly granulated. Their summits are too much broken in the single specimen observed for accurate description.

Height .2 of an inch; diameter .25.

Ceylon. Yale College Museum.

DIASERIS PULCHELLA Verrill, nov.

Plate 1, figure 3.

Corallum subcircular, showing usually from two to five lobes, but sometimes nearly entire. The lobes are more or

less distinct, very irregular in form and mode of union. A young specimen about a quarter of an inch broad shows indications of having been attached at the center below by a peduncle originating from the inner angle of the larger of its two lobes. Lower surface slightly concave, evenly costate with delicate, elevated, nearly equal costæ, which are sharply granulated near the center and finely dentate towards the margin. The latest cycles of septa reach only part way to the center. The outer edges of the septa are thin and evenly rounded and the upper surface of the coral is convex; central fossette deep, slightly oval, rather large. Septa apparently in five cycles, with some members of a sixth in some specimens, closely crowded, very unequal. Those of the two first cycles subequal, more prominent than the rest, especially towards the center, where they become also considerably thickened; inner edges perpendicular; summits rounded; edges like those of all the septa, deeply incised, and lacerate-toothed, the teeth mostly branched; surfaces strongly granulated. The septa of the third cycle terminate inwardly before those of the fourth, which unite in pairs and extend to the fossette, those of the fifth cycle usually joining them near the middle. The inner portion of the third and fourth cycles are thickened and in life surmounted by conical tentacles, which are more removed from the center as they are younger; latest septa very thin. Columella little developed, papillose; a vertical section shows the wall to be very thin and imperfectly developed; the septa deeply lacerate at the edges and perforated by many irregular openings, the teeth originating from their inner bases simulating pali; their sides granulated with points arranged in rows which curve outward and upward from the lower side.

Diameter of largest specimen 1 inch; height of a specimen .5 of an inch in diameter, 12.

Color of living polyp "mottled greenish gray above, tentacles, one to each ray, bright green."

Foukow Bay, Island of Ousima, in 20 fathoms on a hard sandy bottom; several specimens. Dr. Wm. Stimpson.

EXPLANATION OF PLATES.

PLATE 1.

Figure 1, *BALANOPHYLLIA CAPENSIS* Verrill, living polyp, somewhat enlarged.

Figure 2, *DENDROPHYLLIA GRACILIS* Edwards and Haime, living polyp, natural size.

Figure 3, *DIASERIS PULCHRELLA* Verrill, living polyp, somewhat enlarged.

Figure 4, *DYSACTIS MINUTA* Verrill, living polyp, natural size. Color brownish, body white. Bonin Island.

Figure 5, *SAGARTA RADIATA* Verrill, living polyp, natural size, in contraction; 5 a, disk and tentacles; 5 b, a tentacle enlarged. Column with longitudinal bands of brown and white. Kagosima Bay, Japan.

Figure 6, *TRALIA COCCINEA* Verrill, arrangement of the tentacles and mouth. Column cylindrical, longer than broad, bright red. Kagosima Bay, Japan.

Figure 7, *CERIANTHUS STIMPSONI* Verrill, profile view, natural size; the tentacles on one side omitted for greater distinctness; 7 a, arrangement of inner tentacles. Bonin Islands, 10 fathoms, in coral mud.

Figure 8, *MELACTIS ANNULATA* Verrill, natural size, in full expansion; 8 a, disk and tentacles enlarged. Column light reddish purple, with a scarlet ring surrounding it below the base of the tentacles, disk and tentacles, pink. Cape of Good Hope.

The preceding figures were all drawn from living specimens, by Dr. Wm. Stimpson.

PLATE 2.

Figure 1, *BALANOPHYLLIA CAPENSIS* Verrill, natural size; 1 a, view of cup from above, enlarged.

Figure 2, *DENDROPHYLLIA GRACILIS* Edwards and Haime, natural size; 2 a, cup enlarged.

Figure 3, *EUPSAMMIA STIMPSONIANA* Verrill, natural size; 3 a, cup natural size.

Figure 4, *STEPHANOSERIS LAMELLOSA* Verrill, natural size. (In this figure the artist has represented the septa as too uniform in size and prominence, owing to the summits of some of the principal ones being broken.) 4 a, cup much enlarged.

Figure 5, *FLABELLUM*, natural size.

Figure 6, *HETEROCYATHUS ALTERNATA* Verrill, natural size, view from below; 6 a, upper surface enlarged.

Figure 7, *PLESIASTREA INDURATA* Verrill, portion of a specimen, natural size.

IV. *Researches and experiments upon Silk from Spiders, and upon their Reproduction, by Raymond Maria de Termeyer, a Spaniard. Translated from the Italian.*

REVISED BY BURT G. WILDER.

[Communicated July 6, 1866.]

REVISER'S PREFACE.

This little work bears no date, but appears to have been published at Milan between the years 1810 and 1820. The only copy which I have seen or heard of was, according to the letter of presentation, given to Baron de Walckenaër by Mons. de Bearn in 1833, and, at the sale of the Baron's library was purchased by Dr. Cogswell for the Astor Library, New York.

Here it seems to have remained unnoticed, until, in the Spring of 1866, one acquainted with my investigations upon the *NEPHILA PLUMIPES* or Silk Spider of South Carolina, was attracted by its title and informed me of its character. Through the kindness of Dr. Cogswell I was enabled to have made a copy of the original Italian, and, in April, the following translation, which has been carefully revised.

At the end of the work are two plates, the second of which portrays the spiders and their organs as described in the text, but now possesses little or no scientific value, and is not reproduced in this translation. The first, however, is exceedingly interesting as being the representation of a process of obtaining silk from spiders, differing only in details from that employed by me at various times and with various modifications since the 19th of August, 1863. (Proceedings Boston Soc. Nat. Hist. Oct. 4th, 1865, and the *Atlantic Monthly* for August, 1866.) A process which, original with me at the time, proved also new not only to all scientific and practical men, to whom it was shown, but even to the experts at the Patent Office in Washington, so that a Patent was readily granted for the *idea or process of obtaining silk directly from living spiders or other insects, by*

a reeling or circular motion applied to the insects themselves. This instrument is, of course, invalidated by the contents of this book, but it is not a little remarkable that an idea so novel, yet so simple, and one would think, so readily suggested by what we may see on any summer's day, should have been conceived and carried out a hundred years ago, and yet that there should be no reference to its nature, scarcely an allusion to its author, and, so far as I can ascertain, no knowledge of its having been published, up to the present time after I have been for three years engaged in carrying out the same idea.

The coincidence holds still further with the experiments, and anticipations; but here, I trust, all likeness will cease, and that, so far from dragging out a precarious existence for forty years and then dying of neglect as it did in the Old World, this idea shall, after its present resurrection in a freer atmosphere, live to be what sober, cautious men already expect of it,—a means of luxury, of comfort and of national wealth.

AUTOGRAPH LETTER OF PRESENTATION.

[Translated from the French.]

As one cannot forget the pleasure one has felt in making the acquaintance of M. le Baron de Walckenaër, no more can one forget the engagements one has made with him. I fulfil that which I made, in sending to him this little work upon his protégées, the spiders. They will be to him a celebrity, and I know well that the world will envy them the honor of having such an historian.

I pray Mons. le Baron de Walckenaër to deign to accept the assurance of my high consideration.

Lef^{ts} (Lecomte?) de Béarn.

At the chateau de la Rochebeaucourt, the 15th day of October, 1833. Near
Mareuil, Dordogne.

To Monsieur le Baron de Walckenaer.

PART FIRST.

SPIDERS' SILK.

In the years 1777 and 1778 I published¹ two memoirs upon the silk of spiders, setting forth briefly the experiments made by me, both in America, where I passed many years of my youth, and in Italy, where I afterward lived, as to what profit can be derived from these insects which we consider disgusting and even venomous; propagating them by the easy method which I taught, and drawing from their multiplied cocoons, either by spinning or by carding them, and even from their *living bodies*, the finest silk, shining and abundant. I know that it now appears and will, perhaps, still appear a paradox to say that greater profit can be drawn from spiders than from silk-worms; but whoever has read my above mentioned memoirs, and shall also read this, will be persuaded of it, and if he wishes to make a trial of it, using the care and methods prescribed by me, he will be convinced by the fact.

And, first of all, I see the necessity of refuting the general opinion based chiefly upon the authority of Réaumur, who, having made researches upon this very subject, while he admits that from the cocoons of the spider a considerable product may be obtained in silk both fine and coarse, finds so much difficulty and so many obstacles that he considers as futile the attempt to make use of it.* The authority of the French entomologist is certainly of great weight and I, as well as others, have always admired his sagacity and diligence in studying the nature and habits of insects, and the good or harm which they do or of which they are capable; but I shall not, I hope, be considered at fault if, having, by researches and experi-

1. Selection of interesting pamphlets, Vol. iii, page 288, and selected pamphlets, Vol. i, page 49.

a. Réaumur's report upon this subject may be found in the *MEMOIRS OF THE FRENCH ACADEMY* for 1710, and a synopsis of his conclusions and those of Le Bon is contained in the *ENCYCLOPÆDIA BRITANNICA*, article *Arachnida*, and in *LARDNER'S CABINET CYCLOPÆDIA OF USEFUL ARTS. Silk manufacture*. Both of them erred, through zeal, in their calculations, so that neither is reliable, far less so certainly than our author. [REVISER.]

ments similar to his, arrived at opposite results, I shall undertake in the first place to enquire what weight or foundation the difficulties which he proposes, may have; then I shall add my own observations upon the natural history and especially upon the propagation of spiders which I believe to be new and important, and, above all, tending to prove that they may be cultivated so as to derive advantage from their silk.

The obstacles which Réaumur considers strongest and, in his opinion, insuperable are: 1st. The difficulty of obtaining such a number of spiders as shall give a product sufficiently great to compensate for the labor and equal that which, with less inconvenience, may be obtained from the silk-worm. 2d. The extent of space which a colony of spiders requires, both from the length of their threads and the webs and from their ferocity which leads them, when they find themselves near and especially when incommoded, to devour each other, whereas for the silk-worms only so much space is required as is occupied by their bodies with a little additional space for the construction of their cocoons. 3d. The necessity of feeding spiders greedy and thirsting for the blood of living creatures, and the extreme difficulty of obtaining this; while silk-worms are easily fed with leaves and in some places are allowed to live upon the trees with no other care than that of gathering their cocoons. 4th. The small quantity of silk which is obtained from the spiders in comparison with the products of the worms. 5th. The quality of spiders' silk, far inferior in brilliancy and consistence to that of the worm.

Wishing then to show how profitable the culture of spiders for the production of silk may become—more profitable even than the culture of silk worms—I have only to prove the invalidity of the objections here stated.

I.

FACILITY OF MAKING AN ABUNDANT COLLECTION OF A GIVEN SPECIES OF SPIDER.

Réaumur himself admits that whereas spiders can be sought in all the corners of uninhabited houses, among ruins, under floors, upon the trunks of trees and espec-

ially among their branches, a numerous colony can be easily and quickly formed. But, these being spiders of various kinds, besides the difficulty of affording them subsistence, since each species provides for itself in a peculiar manner, there would result from all those together a silk scant in quantity, uneven, and unfit for use in the arts. It is true that in the course of his researches he found it necessary to separate the species in order to recognize the product of each and to decide which was the best suited for rearing, but he did not examine the matter with the sagacity which we had a right to expect from the father of entomology; since he did not conclusively determine what species of spider is most industrious and therefore preferable. He says, indeed, that the fourth species is, for cultivation as well as for productiveness, the most desirable. But how does he determine the species? He says it is that which ordinarily stands perpendicular to the horizon, and to which Homberg gives the name of *garden spider*, although it is commonly found in the woods and among bushes, and he adds that it contains a great number of secondary species varying in size, in figure and in color; he says that all these spiders spin threads useful in some manufactures but that some give silk so weak as not to be serviceable for solid work.

Any one can see how obscure and indefinite is this style of description of Réaumur's, which seems to confound species (genera?) with varieties (species?) and to deduce specific differences from variations in size and color; characteristics which may depend upon age, food, &c.

Afterward, without sufficient ground, he asserts that the spiders live in continual war among themselves, and destroy each other; whence it would be difficult, if not impossible to multiply them enough to obtain any considerable product. We, not knowing whether the spiders which had the credit of this were of the same or different species, could not determine if their voracity and cruelty are manifested among individuals of the same or among those of different species, and I should add that this voracity, not natural to the spider, may, however, be occasioned by the narrowness of their prison and by hunger.

I have elsewhere indicated the method of the trial by me of obtaining a great abundance of spiders in a very short time. We shall see that the female of the spider called by Linnæus *diadema*, very common with us, makes five or six cocoons every year, the first of which contains eight hundred eggs, and the last about four hundred. Now, taking the average, we may calculate that each spider will produce annually about four thousand little spiders, and from twelve hundred spiders we should have about fifty-thousand eggs. It is an easy matter to obtain twelve spiders of one kind and to have a much greater number of them if attention is given to the place where a certain species is wont to establish itself, so that always such a place may be selected for it as is believed to be the best adapted to its preservation and subsistence. Thus the domestic spider is always in the corners of walls, the *diadema* under balconies, the *angulata* among bushes, etc. Since Réaumur collected, as he said, spiders of various species and the small mingled with the large, it is no wonder that the former became food for the latter especially if hunger impelled them to it.

I am accustomed, on finding the cocoons of a spider known to me, which I wish to select, to take them, to cut them across superficially in order to ascertain the quantity of eggs; and to replace the latter upon cotton in a box well protected from dust and insects. There, in due time, I see them come forth, and place them where I wish to feed them. Every one can see how easy and how abundant, with this method of mine, the increase of the spiders may become

II.

FACILITY OF REARING SPIDERS.

Réaumur found that his spiders perished in a short time, being, as he said, destroyed by one another. It is very probable to suspect that they rather perished of hunger, not having, in the boxes where he placed them, means of procuring suitable food; or that the weaker were devoured by the stronger because he had mingled different species. But I must acknowledge, because experience has taught me, that

spiders of the same species accustomed to each other's society mutually destroy each other whenever they extend their webs and threads into places where they may encounter them. All then (in the adult state?) wish to be alone and will not endure a neighbor who may interfere with their plans.^b

In order to obviate this inconvenience I made cases so that each spider could occupy his own little house and not extend his dominion beyond it. In this way, in one year I took from 2146 spiders, at one time, 1714 cocoons and at another time I collected 2134.^c Réaumur never made so great a collection. I know well that the expense of these cases will be considerable when the cultivation of spiders is undertaken very extensively; I have, however, a more simple and advantageous method.

In August and September I go in search of the mother spiders in the places which I consider most suitable, and it is not a difficult matter to find in houses and about hedges many hundreds of them. In fact, I did find them, and shut each one in a box of pasteboard or paper, covering it on two sides with a veil or with perforated card, putting into all but a few of the boxes two or three living flies. In due time I found in each paper box a cocoon. I had also been able to make use of such simple boxes as President Le Bon made. Having completed the collection I set the spiders at liberty in the places where I had taken them.²

b. Probably all young spiders are gregarious for a certain time after they leave the eggs, and one large South American species is said to continue so during life. That this is not impossible is shown by the certain existence of a gregarious spider *Neriene errans* in England. ANNALS OF NAT. HIST., 3D SERIES, VOL. VI, 1860. [REVISER.]

c. He does not distinctly say that these latter were produced by the same individual spiders as the former. [REVISER.]

2. When I was in America, travelling over the great Ciaco, I collected thus 2484 very large spiders, which, being then placed upon a double row of pomegranate trees, gave me 2013 great cocoons of the best yellow silk. I took out the eggs from the cocoons, which (calculating six cocoons for each spider, and between 600 and 1000 little spiders for each cocoon) exceeding 9 000 000

It is true, however, that by this means one will never make so extensive a collection of cocoons, as by preserving the eggs and rearing in cases the little spiders which come from them. Spiders could be kept in houses, were it not for two circumstances,—the opinion that they are *noxious* or *venomous* (which is not true),^d and *cleanliness*, which, perhaps, is not always well considered; because, if on the one hand, the cobwebs disfigure the walls and furniture, on the other, they rid us of an infinite number of disagreeable, noxious and disgusting insects, and that this may not seem a paradox, let us consider the innumerable flies of many kinds, of mosquitoes and of other insects which fly about us, of bugs and fleas that are taken by the spider *ophlionoide*, which extends its horizontal net near the level of the earth, and under tables and beds. Thus in spiders' nets are left hanging the flies, which, not content with eating or defiling food destined for man, make it a feeding-place for their worms; and even more useful are spiders in collecting the butterflies and moths, the dermestes, acari, etc. I do not mean by this, that we are to allow spiders to encumber our rooms and our beds. I merely declare that the cruel war we are accustomed to wage against them is not a profitable thing. Spiders ought at least to be found useful in stables, where they devour both the common fly and the gad-fly, so troublesome to horses and cattle, and also in wine-presses, where so many insects are flying about while the must is forming.

Although, for the aforesaid reason of cleanliness, spiders may not be desirable inmates of houses, no one will object to their being nourished upon the trees, in gardens and fields; but since birds and reptiles, and also other insects make them their prey, if you wish to rear them in great numbers, it will be necessary to protect them, at least, at first, since at the time of hatching, their foes make great havoc among them.

in number, would have given me as many little spiders the next year. But an unexpected command and an irresistible power called me away from that country. What a pity, and what a loss!

d. It probably is not true to the same extent with all spiders. [REVISER.]

III.

EASE WITH WHICH SPIDERS MAY BE FED.

With Réaumur, a great and insuperable difficulty, is that of feeding with flies such a number of spiders as might yield a profitable result, "all the flies in the kingdom" he says, "would not suffice to feed spiders in such a number that any profit can be derived from them." But, in the first place, I find that he himself ascertained that flies were not the only food for spiders, having nourished them with bits of earth-worms cast upon their webs, and with pieces of the tender quills of doves and chickens, which they sucked with avidity.

In the second place, I observe that feeding the spiders upon flies is not a difficult matter, since they collect in great numbers when honey or any other food of that kind is placed near the abodes of the spiders, either in a room or out of doors. I prefer the method of collecting the spiders in the field and bringing them into a very light room, where, at a height above a man's head, are placed some canes, to which they may attach their webs. The lightness and good exposure of the room enable them to catch their food by day, and in the night they employ themselves chiefly in spinning their webs, or in forming their cocoons. I think it advisable too, after a considerable number of flies have entered, to prevent with a thin, cheap veil, the ingress of birds and insects hostile to the spiders.

In order that the flies may collect, I have found useful, after repeated experiments, the method proposed twenty-five years ago, namely, to put small bits of putrifying meat, upon a little stand supported by a stick nailed into a box, filled with pulverized earth. The female flies deposit upon the flesh, eggs, which soon become larvæ or maggots, which, when they have reached a proper size, throw themselves or fall into the earth, are changed to pupæ and finally become flies. If the odor of the putrid meat is objected to in the room where the spiders are, it may be kept in some more convenient place, where the flies can deposit their eggs, and, when the worms have fallen into the earth, the box containing them may be put in the spiders room until the flies have

come out. This is something of a contrivance, it is true, but yet so simple, that multiplying the flies gives little trouble.⁶ In this way, their food being abundant, the spiders are able to remain always in the same place, without being carried to the spot where they were taken, because they feed themselves, and render themselves able to produce new cocoons.

By this means, too, we are enabled to keep the spiders during the winter, the room being warmed, so that they shall not perish. But spiders, like the majority of insects, pass the winter in a dormant state, and therefore without need of food. And it is here to be remarked, that spiders, more perhaps than any other insects, can endure long abstinence from food, as has been noticed by all observers of their habits, and especially by Redi.³ It is true that these cocoons are then smaller, and the eggs in them less numerous, but yet the spiders will live, work and multiply without food.

If they are reared, not in the house, but in the fields or in gardens, with the care above mentioned, it is well to consider two things. 1st. Their number will be diminished on account of their many enemies, but whenever man does not make war upon them, this diminution will be in great part compensated by their multiplication. 2nd. The first year they will give few cocoons but afterward they will give them abundantly. I ought to add that it will not be so easy to collect their cocoons as in a room, but it must also be remembered, that the product by the former method costs only the labor of collecting, and this is not a very difficult matter, since they are generally to be found under planks and tiles, if there are any in the vicinity, and always in places where they are nearly concealed from their enemies, and not exposed to the sun or rain.

e. Perhaps some of the new fly-catching machines may be found useful.
[REVISOR.]

3. Experiments at the Institute, Vol. i, page 81.

IV:

QUANTITY OF SILK PRODUCED FROM SPIDERS.

Réaumur, intent on showing that no commercial advantage can be drawn from the silk of the spiders, endeavors to prove that but a very small quantity can be collected; and, in the first place, he makes a comparison between the cocoons of the common silk-worm, and those of spiders; and finds, that one of the first weighs about four grains, whereas the cocoon of even a large spider weighs hardly one grain; and this being also, for the most part, mixed with dust and with the shells of the eggs, it follows that the silk of a spider's cocoon, will be hardly one twelfth of the cocoon of the silk-worm. It may be added, he says, that all the silk-worms produce cocoons, while among spiders it is only the females that make them. He concludes, therefore, that 55296 of the largest spiders are necessary to produce a pound (16 oz.) of silk; while 2304 cocoons of the silk-worm are sufficient for the same result, and thence he argued that rearing them is not promising and can not be made profitable.

But in this calculation of Réaumur's there are many data to rectify. 1st. There are very few cocoons of the silk-worm which weigh four grains; generally, unless they are made to work inclosed in paper boxes, they do not weigh more than three grains, and De Pluche found that they did not exceed two and a half grains. 2nd. He attributes to the spiders, as to the silk-worms, only one cocoon a year, and we have observed and shall see in what follows, that sometimes they produce even six. 3rd. He says that the cocoon of a spider, even of the largest kind, hardly weighs a grain, whereas I have found a much greater weight, I am certain that two cocoons of an American spider, the species of which I have not yet determined, weighed as much as one of the silk-worm's before being cleansed; and after being cleansed, they had lost less than half their weight. In America, moreover, I found some cocoons of those very large spiders, called by Linnæus *Aranea avicularis* because they carry away even humming birds from their nests, which weighed as much as six cocoons of the silk-worm when they

were unwashed and as much as three or four after having been washed.⁴

4. As this spider is little known, it will not, I flatter myself, be displeasing to the reader, that I should give him an exact idea of it. It is indigenous to almost all South America; where it is called Abamdui, or Nbandu-guasú, that is the *great spider*. In fact from its size it may be called the atlas of spiders. Its color is in some gray, and in others dark and black, which colors are probably indications either of age or of sex. Linnæus found in two of them which he had before him great difference in the size of the thorax, which in one was double that of the other; but he did not find in their palpi indications of a difference of sex. They are all hairy and bristly. The under part of the head, the palpi, and the tarsi of the legs are of a reddish color. They have at the mouth, two very strong nippers or jaws, curved, black, and of a horny substance. They are furnished with eight eyes, smooth and raised from the head. The thorax is round, blackish before, more convex and margined on the upper part, while in the midst is a disk of long hairs, gathered into little bundles. Less convex is that part behind, in which is seen a deep transverse fissure separating the long hairs; the abdomen is also hairy and at its extremity are two long appendages. These spiders are two inches and one fifth in length and the thorax is an inch in diameter. They have eight hairy legs, terminating in fleshy pads. I do not know whether this spider belongs to the hunting or to the working spiders, that is whether or not it makes its web in order to take insects, since I always observed it wandering over the ground or upon the trunks of trees or concealed in the earth. If it does not find insects enough for its food, it boldly attacks humming-birds, small birds a little larger than itself, while they are upon the eggs or upon the young birds in the nests, and if it cannot have the parent birds, it feeds upon the young and upon the eggs. This great spider produces cocoons proportioned to its size, containing thousands of eggs, and places them in the fissures on the trunks of trees. The cocoon is three inches long and one inch and a quarter of a line broad. This extraordinary size of the cocoon has made the inhabitants, who do not observe carefully, imagine that this spider would take the cocoon of the bombyx moth del Guyavo (*Janus* Linn.) and having destroyed or eaten the chrysalis would place her own eggs there, and then artificially close the hole by which she had penetrated it. The celebrated Mademoiselle Merian lent credence to this common opinion, but she did not examine the matter, or she would have seen that there were not within any remnants of worm or of chrysalis nor any indications of a hole by which the spider might have penetrated, neither any difference in the silk of which it is composed, a difference inevitable if the spider had supplied with her own that which she had destroyed in opening for herself a wide way into the cocoon of the moth. After Mademoiselle Merian, it did not occur to any other naturalist to doubt that this cocoon was the property of the spider, like

But without seeking the American spiders, we have, and I have myself found in this country, the spiders which Pallas calls *Aranea speciosa*, and which Razomorsky calls *Aranea pulchra*, which make such cocoons that three alone not cleansed, and five free from all impurities, weigh as much as one cocoon of the common silk-worm. I will also add, that having, during this year, verified my observations on the cocoons of the *diadema* spiders, I have found constantly that six of these, and not twelve as Réaumur would have it, are equivalent to one cocoon of the silk-worm.

But even less than six are sufficient. I have observed that if I take the cocoon from the spider, when it is hardly formed, and take the eggs from it, the cocoon, which I call then the virgin cocoon, remains very clean, and since it loses nothing, it is so heavy that only four are equivalent to one cocoon of the silk-worm. In this way, in order to produce a pound of silk, there will not be required, as Réaumur says, more than 55296 cocoons of the spider, but 13825 will suffice. In order to show the advantage which the silk-worm has over the spider, Réaumur observes that among spiders the females alone make the cocoon, whereas, among silk-worms, the males produce as many as the females; whence, considering the number of individuals of the two sexes to be equal, he supposes that double the number of spiders is required for an equal number of cocoons. But beside that his supposition is not true, as we shall see, he does not observe that the silk-worms give but one cocoon a year; whereas the female spiders give even six as already stated. Réaumur was ignorant of that, although Lister² had previously

all the others which contain the eggs of spiders. We ought not to wonder, says Lyonnet, speaking of other mistakes taken from Mademoiselle Merian, that in this a lady may be deceived who is more intent on drawing well, than on studying insects. Besides, in a foreign country, it is natural to believe the natives in regard to common objects. I even put faith in the Indians, who gave me to understand that the wood of their arrows was very hard, because, putting it in the fire, it could be drawn out and, being compressed, lengthened, acquiring thus compactness and strength. I published that in good faith (Opusc. Sult. pag. 377, nota) but being informed of my error by my colleague, who has studied the arts of the Indians more than I, I voluntarily confess and retract it.

written that they made two or more. But no one, so far as I know, before me, followed up this matter, so as to determine how many cocoons a spider produces in one year: and I can assert from the observations of many years, that a female spider well fed produces annually six cocoons, which I have specially noted in the *diadema* spider, most frequently the subject of my researches.

It is true, that the six cocoons do not always contain an equal number of eggs, but the last five may be at least calculated to equal in this respect three of the first; we should have then the same proportion for the silk, and we should suppose that a spider would produce only four cocoons equal to the first. With these data are diminished three quarters the number of spiders which Réaumur requires to produce a pound of silk.

Another consideration tending to diminish the number of spider's cocoons required by Réaumur to equal the cocoon of the silk-worm, we may find in his wish to calculate this as weighing four grains, while it hardly ever weighs as much. De Pluche⁶ attributes to it only a weight of two and one half grains, and Lyonnet⁷ calls it three grains which is correct when the uncleansed cocoon is taken. But if it is cleansed from dust and from the remains of worms and chrysalids, as Réaumur wishes the cocoon of the spider to be cleansed, then we can only give it the weight which De Pluche assigns it and which I found always the same, after having drawn out the silk in the kettle, that is, after having separated it from the gum which is not silk.

V.

VALUE OF THE SILK OF SPIDERS.

Lastly Réaumur considers the culture of spiders unprofitable, because their silk is, in his opinion, of no value or use. He distinguishes the silk with which spiders make their cocoons and maintains that the first is eighteen times more delicate than the second; in which he makes a mis-

5. Concerning spiders in general. Chap. i, page 3.

6. *Spectacle de la nature*. Tom. i, entr. 3.

7. *Théol. des Insectes*. Tom. ii, part ii, Chap. i.

take, both being of the same quality, and the difference consisting in the threads of the second being more multiplied. But, however this may be, it is of little importance, as I do not purpose to draw any profit from the webs of the spiders.⁸ The silk of the spider's cocoon is, according to Réaumur, five times more delicate, and therefore more weak than that of the silk-worm, which he ascertained by experiment; since while a thread of silk from the last sustained 180 grains, a thread from the first sustained only 36. He inferred from that another defect, that is, the necessity of combining many threads, in order that they may have any strength whatever, which ought to and does injure their brilliancy, which is still impaired by the impossibility of spinning, and the necessity of carding the cocoons, reducing the threads not to silk, but to floss, or to coarse sewing silk.

But are these defects revealed by Réaumur in the silk of the spider really such? Are they truly defects? The fineness of the thread will not certainly be considered a defect, since otherwise we ought to prefer to the cocoon of the common silk-worm, that is the moth of the mulberry tree (*Phalena Mori* L.), that of the *Phalena pavonia*, which has many threads, larger and of more consistency; a statement which no intelligent judge of silk will make. The delicacy of the thread of the spider's silk should not therefore be considered a defect; and if, on account of this delicacy, the thread is weak, as it must be, we have only to combine more threads in order to obtain the necessary firmness. Are not the very threads of the silk-worm's cocoon combined in order to produce a thread strong enough for manufacturers?

I agree with Réaumur that by reducing the cocoons of the spider to the state of ferret (coarse sewing silk?), and spinning them then with the distaff, they lost their native brilliancy; but here it is proper to note two things:—

8. I speak of the European since the great spiders of which I have spoken make webs so strong that their threads sometimes incommode those who walk in the roads occupied by them, and more than once they have made me fall before the thread has broken. The same spider has been observed in Mexico (see Blosin Busch) where there are also spiders which make webs of many colored threads.

1st. The thread of the spider's cocoon carded, ought not to be compared with the thread of the silk-worm's cocoon treated with warm water, but with that which is made of floss. 2d. The thread of the spider can be wound 'also in its natural state, and it becomes then much more brilliant than a thread of any cocoon whatever. It cannot be unwound by placing it in water, since it does not float, and having no gum to be dissolved (except on the side by which it was attached to the ceiling) the thread cannot be unwound little by little. I can speak of having learned so much by myself in drawing the thread from a cocoon, but I could never draw it longer than a foot, chiefly because at the point where the cocoon was gummed by the spider, in order to attach it, it always broke. I succeeded once with infinite patience in dissolving that gum, and in taking the eggs from the cocoon without breaking the threads; but being obliged at that time, in 1796, by the siege of the fortress near my house, to abandon it, these researches being interrupted I never more resumed them.

But I made at that time another observation, which guided me to a more fortunate experiment. I saw that when the spider *diadema* took an insect, it drew out from the spinner placed at the extremity of the abdomen, some large threads, and enveloped it in a brilliant white web formed at the instant, and so strong that the insect, although sometimes it was a black beetle or a grasshopper, lost all motion. From this I argued that if I could have drawn similar threads, I should have had a strong and beautiful silk. I succeeded in fact, holding the spider by the corslet and touching the spinner, in drawing the silk; but I saw that by contracting the spinner, and yet more, by grappling with the long legs behind, he soon cut the thread. I could hardly remedy the contraction of the spinner, but I found a remedy for the second inconvenience, by placing the spider so that it could not touch the extremity of the abdomen (See fig. 3, Plate 1). This is the little contrivance which I devised. In a piece of cork (a) I made a small cavity, and a hollow place of nearly equal size in a sheet of tinned iron (b), about an inch wide, to which were soldered two iron pins or wires (c-c) which were introduced into the cork.

Upon this the spider was placed so that the sheet of iron falling between the corslet and the abdomen, held him secure in that place, so that he could not extend his legs behind, as is seen in fig. 4.

Fig. 3.

Fig. 4.

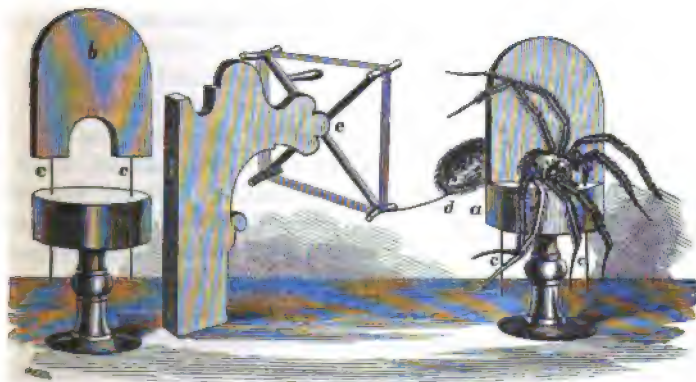


PLATE 1. [REDUCED.]

I have also found a method by which I can easily take the silk or allow it to be drawn from the spinner. I present a fly to him; he takes it quickly with the palpi and turns it over as if he would envelope it. I raise the abdomen, and at the first touch he opens the spinner (d) and permits an abundance of silk to pass out. I then attach the end of silk to a little reel four and a half inches in diameter, with cylindrical arms of glass which I slowly turn and wind the silk of the spider like that of the cocoon. If, by the caprice of the spider, or for any other reason, the thread is broken, I again attach it as is done with the silk of the silk-worm drawn from the cocoon immersed in warm water. I have wound upon the same small reel a band of spider's silk, and a similar band of the silk of the silk-worm. The comparison shows evidently how much more brilliant and beautiful the first is than the second; so bright that it appears more like a polished metal or mirror than

like silk. But it will be said that such silk cannot be taken from the reel and brought into threads, and that is true, but let it not be said to me that it is of no use. I caused it to be spun with the distaff, and I had a very fine and brilliant thread, which had beside such elasticity as to stretch considerably without being broken, and to return again to its first dimensions, which will be very useful when there shall be a sufficient quantity to weave or of which to make a netted or knitted fabric.

I am also of the opinion that with a simple contrivance having a few of the arrangements described for holding the spider, it would be possible to draw the silk from all the spiders at once, and to do it so that the threads uniting would twist to form a single thread, as is done with the threads of the cocoon; whence both from its consistence and size it could be easily wound from the reel and worked.

Notwithstanding what I have just said to prove the profit which can be drawn from spiders, or rather to cancel in the mind of him who has read Réaumur, what he says to the contrary, let no one imagine that I expect to induce men to undertake the rearing of spiders instead of silk-worms. It is enough if the readers of this are persuaded that here is a branch of industry and commerce little attempted as yet, and little known, from which those will be able to profit who have industry, energy and determination. But whoever undertakes it must be prepared first of all to be regardless of ridicule.

The silk of spiders has another advantage over that of the worms, viz. that it is often naturally tinted with beautiful colors. Lesser⁹ thinks that these colors are voluntarily given by the spiders, and Lyonnet believes they are the result of accident. I think the spiders have different repos-

f. This very thing was done by me with several spiders during the Fall of 1864 and the Summer of 1865. Termeyer's apparatus for securing the spiders may be improved upon in several ways; as, for instance, by holding the insect upon its back so as to expose the spinners, and by adapting the notch which holds it to the shape of the insect so that it shall suffer no injury during the operation. [REVISER.]

⁹ Loc. cit.

itories for silk of different colors and adopt now one and now another, not interlacing the colors by design, but according to need and circumstances. Others have observed that the silk of which they weave their circular webs, is of different kinds, the radii, stretching from the centre to the circumference, differing from the threads which form the concentric circles; the second are viscous, but not the first. It is also known to entomologists that the spider has six spinners or *mammulæ*, as we will call them, whence the silk issues. Why may we not believe that from each comes a silk, different either in color or in some other property?⁸

Another quality of spider's silk is the unchangeableness of the original color; the weight also is unalterable; that is it did not diminish by any washing or any application of soap to which it was subjected, of which I have assured myself by various experiments made upon different specimens of my silk, and especially upon a pair of stockings made of spider's silk and designed for his Majesty Charles III, my beneficent sovereign of glorious memory.¹⁰

Beside the original color, the silk of spiders may be dyed with whatever color one wishes to give it, excepting that not having usually a white color in the beginning, like the washed silk, the dyes show less clearly.

I foresee that more than one will say if the silk of your spiders is so adapted to manufactures, if it is so abun-

g. A valuable suggestion which has been anticipated however, with regard to the *Nephila plumipes*. [REVISER.]

10. The silk obtained by carding the cocoons of the diadema spider was spun in my house by Lucrezia Rasponi, who then made of it a pair of stockings of proper size. Having intended them for the King, my Lord, of whom I considered them not unworthy, not so much on account of their value as on account of the novelty of the thing, I sent them to Sig. Car. d'Azan, his Minister, who deigned to assure me that he had sent them to Sig. Conti di Florida Blanca, then Prime Minister of the King, together with my letter. I cannot understand from what unfortunate combination of circumstances I have never been able to discover if they were truly presented to the King in my name. I know that I was very sensible to the loss of the fruit of so much long-continued investigation and hard work. My many friends who saw them admired their fineness and consistence. They weighed two ounces and a quarter.

dant or may become so by the facility of obtaining and rearing them, by collecting it from the cocoons, and by drawing the threads from the spider, why, since you have now been occupied with this subject for forty years, have you not made stuffs and netted goods and other fabrics in great abundance, whence some profit might have accrued, and the incredulous have been convinced by results, so much more successful arguments than reasoning? I should be quite in the wrong to disdain any inquiry so put; but I reply that where the reasoning is sound and based upon unquestionable experiments, even though it may not be confirmed by experience, it should not therefore fail to convince. I reply in the second place, that I have in fact collected, I will not say a great deal of the spider's silk, but a quantity sufficient to make several purses, which I gave to my friends, and the abovementioned stockings; and I had already in 1796 prepared twenty-two ounces of such silk, taken from virgin cocoons, hardly completed by the *diadema* spider, and therefore very clean; but, in the hasty removal of my goods on account of the siege of the fortress, it was lost or stolen. I will reply thirdly, that what I have not done was done by President Le Bon in the last century, when he collected spider's silk in quantity sufficient to form a suit of clothes, which he presented to Ludovic XIV, of which we have Lesser¹¹ to witness, and the renowned Latin poet, Vaniere,¹² who relates it both in prose and verse in a little work dedicated to Le Bon himself; it cannot be supposed that he was deceived, or wished to deceive others, when, speaking of the spider, he sung,—

“ Illins, inspreto serum jam munere, Reges
Stamine membra tegunt.”

Let us conclude. The difficulties proposed by the celebrated Réaumur, in the way of a profitable culture of spiders for the purpose of obtaining silk from them, are either surmountable or unreal. They can be obtained in great numbers, are easily collected, multiplied and fed, producing many cocoons, and giving much silk, and this is strong, beau-

11. Vol. II, Book 2, Chap. 1.

12. Eclogue to the illustrious Le Bon. Tolos. 1724.

tiful and well adapted to manufactures. It remains now for me to speak of their propagation, and while the statements I shall make will interest the naturalist, they will confirm my preceding assertions.

PART SECOND.

GENERATION OF SPIDERS.

I have already observed that Réaumur, in his calculation supposes as many of the individual spiders to be masculine as feminine. Is this true? So Aristotle and Pliny wrote, not admitting in their polygamy but one sort of conjugal society.^h President Le Bon, who was one of the first to examine them in this respect, inclines to think them androgynous and hermaphroditic, and it would be said, that Réaumur himself had some suspicion of that. It is certain that it may be perceived from his writings, that he has not well described the sexual parts, and he is, notwithstanding, sure of the manner of their copulation.

Naturalists, following in the footsteps of Aristotle and Pliny, always speak of the ferocity of spiders, owing to which they devour, not only their companions and brothers, but even their parents, and there are few who refrain from eating their lovers and their mates. I was, in my first investigations and observations, so unfortunate, that, not having ever seen them couple, I supposed them hermaphrodites and able to give fertile eggs without union. But time, patience, constancy and I may even say persistence, have enabled me to see and recognize what no one had seen before. The following is the result of my observations on the sex of spiders.

The *diadema* spider was that which I examined specially in order to understand the generation and thence the sexual organs. For greater clearness, I give here a figure (Plate 2, fig. 1.¹) representing the female of this spider of

h. An obscure passage: "non ammettendo in loro poligamia, ma una specie di societa conjugale." [REVISER.]

i. It was not thought worth while to reproduce this second plate in the present translation. [REVISER.]

the natural size. The cross, more or less ornamented, which it has upon the abdomen is its principal distinction. What patience was required to find the male of this spider! He never appears in the centre of the beautiful webs, and even when I saw him he was, as to the abdomen and palpi so different from the female, which in other respects he resembled, that I should not have supposed him of the same species. He never spins webs, except in the time of his amours or rather before uniting, that is to say, at puberty, but it is then in an angle of an old web of a female which he repairs somewhat; and I have only seen him walking about in the months of his amours which are September and October. I have seen him but once in July.

He approaches little by little, and with much caution, doubtful of the reception with which he is to meet in the web of the female, who occupies its centre intent only on her prey. He commences by touching with one leg a thread of the web; the female approaches him; he flies, allowing himself to hang, then he rises, winding up the thread, when he is assured, by I know not what movement, that he will not be ill received; then he approaches her, and with one of the palpi touches her stomach quickly many times. Then he retires, then returns, repeats the same act and departs, if he succeeds in leaving. I say if he *succeeds*, because I wish to relate what came under my observation in 1798, and which, while it unveiled to me all the mystery of the generation of spiders, presented to me also an argument, if not of the innate cruelty of the female spider, at least of its insensibility and ingratitude. I had put a male and a female of the *diadema* spider together into a box like a drum, closed with a veil at both ends. The male began by making various movements, as if to draw the attention of the female, who pretended not to perceive him, but only from time to time touched some thread of the web. He boldly approached her, directing one of his palpi to her abdomen, and she extending this toward the palp.^k Here is the

k. Also obscure: "Ardito il maschio a lei s'avvicina indirizzando al di lei addome uno de' palpi e stendendo (stendenda?) essa verso quello l'estremità dell' addome." On another page a part of this passage is thus given: "e voltando essa verso quel palpo la parte postica dello stesso addome." [REVISER.]

8. *Buteo Bairdii* HOY. Baird's Buzzard.

A specimen of this fine bird was shot, in 1860, while in the act of pouncing on a tame pigeon in the streets of Oshawa. This is the only instance I have heard of its occurrence in Canada.

9. *Buteo borealis* VIEILL. Red-tailed Hawk.
Breeds here, but is not plentiful.

10. *Buteo lineatus* JARDINE. Red-shouldered Hawk.
Numerous in the fall. A few pairs breed in this vicinity.

11. *Buteo elegans* CASSIN?

If Mr. Cassin is warranted in separating the present from the preceding species, I may notice its occurrence in Canada, as I have a fine specimen, in adult plumage, which was shot at Baptiste Creek a few years since. It differs from *B. lineatus* in being much darker in colour; this, however, in a class of birds greatly given to variation in plumage, does not appear to me to be sufficient to warrant specific distinction.

12. *Buteo pennsylvanicus* BONAP. Broad-winged Hawk.

I have noted extensive migrations of this Hawk in March of different years, as many as twenty or thirty being in view at one time; they passed along at a considerable height, moving in circles toward the North West. Those met with in the woods appeared to be stragglers from the main body.

13. *Archibuteo lagopus* GRAY. Rough-legged Hawk.
Quite common in autumn, when it is observed sailing over the marshes.

14. *Archibuteo Sancti-Johannis* GRAY. Black Hawk.
Rare; similar in habits to the preceding.

15. *Circus hudsonius* VIEILL. Marsh Harrier.
Very rare in adult plumage; immature specimens abundant.

16. *Aquila canadensis* CASSIN. Golden Eagle.

A few specimens of this fine bird have been obtained by Mr. Passmore in the neighborhood of Toronto. Its home, however, is in the mountainous regions of Canada East, and its visits here are few and uncertain.

17. *Haliaeetus leucocephalus* SAVIGNY. Bald Eagle.
Not very rare, a few immature specimens being procured every fall; the adult more rarely.*

18. *Pandion carolinensis* BONAP. Fish Hawk.
Seen in spring and fall; not observed to breed here.

19. *Bubo virginianus* BONAP. Great-horned Owl.
Resident; not very common.

20. *Scops asio* BONAP. Mottled Owl.
Not common.

21. *Otus Wilsonianus* LESSON. Long-eared Owl.
Not common.

22. *Brachyotus Cassinii* BREWER. Short-eared Owl.
More common than either of the three preceding Owls.

23. *Syrnium cinereum* AUD. Great Gray Owl.
Rather rare. Found only in winter.

24. *Syrnium nebulosum* GRAY. Barred Owl.
Rather common. Resident.

25. *Nyctale Richardsoni* BONAP. Sparrow Owl.
Rare winter visitant.

26. *Nyctale albifrons* CASSIN. Kirtland's Owl.
Several specimens of this rare little Owl have been found in Canada within the past few years, one of which is now in my possession. They were obtained in the fall. It may be a rare resident species.

27. *Nyctale acadica* BONAP. Saw-whet Owl.
Not common.

28. *Nyctea nivea* GRAY. Snowy Owl.
Winter visitant. Abundant in some seasons, rare in others.

29. *Surnia ulula* BONAP. Hawk Owl.
Rare winter visitant.

30. *Coccygus americanus* BONAP. Yellow-billed
Have only seen one specimen of this bird in Canada.

*A few years since, a youth who was concealed among the rushes of one of the inlets of the bay, watching for ducks, shot a specimen of the Bald Eagle as it sailed over him; on taking it up he found an unusual appendage dangling from the neck, which, on examination, proved to be the bleached skull of a weasel; the teeth had a firm hold of the skin of the Eagle's neck, about four inches below the bill, and had evidently hung there for some time, as the skin about the wound was discoloured, and the feathers much confused and broken.

31. *Coccyzus erythrophthalmus* BONAP. Black-billed
Common summer resident. [Cuckoo.

32. *Picus villosus* LINN. Hairy Woodpecker.
Not uncommon. Resident.

33. *Picus pubescens* LINN. Downy Woodpecker.
Not uncommon. Resident.

34. *Picoides arcticus* GRAY. Black-backed Three-
toed Woodpecker.

Rare winter visitant; appears with the first snow.

35. *Sphyrapicus varius* BAIRD. Yellow-bellied
Rather common. A few breed. [Woodpecker.

36. *Hylotomus pileatus* BAIRD. Log Cock.

Rare resident. Found only among heavy timber.

37. *Centurus carolinus* BONAP. Red-bellied Wood-
pecker.

On the 3d of May last I shot three specimens of this
bird near Chatham; farther east it is quite rare.

38. *Melanerpes erythrocephalus* Sw. Red-headed
Woodpecker.

Summer resident. Quite common. Arrives May 1st-7th.

39. *Colaptes auratus* Sw. High Holder. [April.
Summer resident. Quite common. Arrives middle of

40. *Trochilus colubris* LINN. Ruby-throated Hum-
ming Bird.

Summer resident. Plentiful. Arrives first week in May.

41. *Chaetura pelasgia* STEPH. Chimney Swallow.
Abundant summer resident. Arrives first week in May.

42. *Antrostomus vociferus* BONAP. Whip-poor-Will.
Common summer resident. Arrives first week in May.

43. *Chordeiles popetue* BAIRD. Night Hawk.

Abundant summer resident. Arrives first week in May.
Departs 10th September.

44. *Ceryle alcyon* BOIE. King Fisher.

Common summer resident. Arrives April 15th.

45. *Tyrannus carolinensis* BAIRD. King Bird.

Common summer resident. Arrives May 10th.

46. *Myiarchus crinitus* CAB. Great-crested Fly-
catcher.

Common summer resident, arriving about the 10th of

May, after which time its harsh cry is heard in all parts of the woods.

47. *Sayornis fuscus* BAIRD. Pewee.

Common summer resident. Arrives 15th of April.

48. *Contopus borealis* BAIRD. Olive-sided Flycatcher.

I have sought in vain for this bird in such places as it might be expected. Two specimens procured near Toronto are all I know of occurring in Canada West.

49. *Contopus virens* CAB. Wood Pewee.

Common summer resident. Arrives 15th of May.

50. *Empidonax Traillii* BAIRD. Traill's Flycatcher. Rare summer visitant.

51. *Empidonax minimus* BAIRD. Least Flycatcher. Abundant summer resident. Arrives first week in May.

52. *Empidonax acadicus* BAIRD. Small Green-crested Flycatcher.

Rare summer resident.

53. *Empidonax flaviventris* BAIRD. Yellow-bellied Flycatcher.

Rare; probably summer resident. Found May 15th.

54. *Turdus mustelinus* GM. Wood Thrush.

Common summer resident. Arrives May 10th.

55. *Turdus Pallasii* CAB. Hermit Thrush.

Visits us in spring and fall; arriving in spring about the middle of April and disappearing about May 7th.

56. *Turdus fuscescens* STEPHENS. Wilson's Thrush.

Common. Arrives as the preceding species leaves, and remains during summer.

57. *Turdus Swainsonii* CAB. Olive-backed Thrush.

Rather rare in spring and fall; not seen in summer.

58. *Turdus migratorius* LINN. Robin.

Common summer resident. A few stragglers in March.

59. *Sialia sialis* BAIRD. Blue Bird.

Common summer resident. Arrives in March, late or early according to weather.

60. *Regulus calendulus* LICHT. Ruby-crowned Wren.

Common in spring and fall. Not observed either in summer or winter. Arrives about April 15th.

61. *Regulus satrapus* LICHT. Golden-crested Wren.
Common in spring and fall. I once saw a pair early in March while deep snow covered the ground; they may have spent the winter near where they then were, but such cases are not common. Arrives about April 15th.

62. *Anthus ludovicianus* LICHT. Tit Lark.
Common in spring and fall. [Creeper.

63. *Mniotilta varia* VIEILL. Black and White
Common in spring and fall. Arrives May 1st.

64. *Parula americana* BONAP. Blue Yellow-backed Warbler.

Common in spring and fall. Arrives first week in May.

65. *Geothlypis trichas* CAB. Maryland Yellow-throat.

Abundant in cranberry swamps, not in marshes or woods. Summer resident. Arrives May 10th. [Warbler.

66. *Geothlypis philadelphia* BAIRD. Mourning
Very rare. Only one specimen procured, May 20th.

67. *Helminthophaga chrysoptera* BAIRD. Golden-winged Warbler.

Very rare. Two specimens procured May 19th.

68. *Helminthophaga ruficapilla* BAIRD. Nashville Warbler.

Common summer resident. Arrives first week in May.

69. *Seiurus aurocapillus* Sw. Golden-crowned Thrush.

Common summer resident. Arrives 2d week in May.

70. *Seiurus novæboracensis* NUTT. Water Thrush.

Common summer resident. Arrives 2d week in May.

71. *Dendroica virens* BAIRD. Black-throated Green Warbler.

Common in spring and fall. Arrives 2d week in May.

72. *Dendroica canadensis* BAIRD. Black-throated Blue Warbler.

Common in spring and fall. Arrives May 15th.

73. *Dendroica coronata* GRAY. Yellow Rump.

Abundant in spring and fall. Arrives April 20th.

74. *Dendroica Blackburniæ* BAIRD. Blackburnian Warbler.

Common in spring and fall. Arrives May 10th.

75. *Dendroeca castanea* BAIRD. Bay-breasted Warbler.

Rather rare; observed in spring only. May 20th. [bler.

76. *Dendroeca pinus* BAIRD. Pine-creeping Warbler. Common in spring and fall. Arrives April 15th.

77. *Dendroeca pennsylvanica* BAIRD. Chestnut-sided Warbler.

Common summer resident. Arrives 2d week in May.

78. *Dendroeca caerulea* BAIRD. Blue Warbler.

Common every spring. A few may breed. Have observed it in June. Arrives second week in May.

79. *Dendroeca striata* BAIRD. Black-poll Warbler. Not very common. Observed May 20th.

80. *Dendroeca aestiva* BAIRD. Yellow Warbler.

Abundant summer resident. Arrives first week in May.

81. *Dendroeca maculosa* BAIRD. Black and Yellow Warbler. Rather common. Arrives May 15th. [Warbler.

82. *Dendroeca tigrina* BAIRD. Cape May Warbler. Rare. Two specimens procured May 10th and 20th.

83. *Dendroeca palmarum* BAIRD. Yellow Red-poll. Rather rare in spring and fall. Observed May 10th.

84. *Myiodioides pusillus* BONAP. Green Black-capped Flycatcher.

Very rare. Two specimens procured May 28th.

85. *Myiodioides canadensis* AUD. Canada Flycatcher.

Summer resident. Not very common. Arrives second week in May.

86. *Setophaga ruticilla* Sw. Redstart.

Summer resident. Common. Arrives 2d week in May.

87. *Pyranga rubra* VIEILL. Scarlet Tanager.

Summer resident. Common. Arrives 2d week in May.

88. *Hirundo horreorum* BARTON. Barn Swallow.

Abundant summer resident. Arrives early in May.

89. *Hirundo lunifrons* SAY. Cliff Swallow.

About as common as No. 88. Arrives 1st week in May.

90. *Hirundo bicolor* VIEILL. Window Swallow.

Not so numerous as either of the preceding Swallows.

91. *Cotyle riparia* BOIE. Bank Swallow.

Very abundant.

92. *Progne purpurea* BOIE. Purple Martin.

Common summer resident. Arrives May 10th.

93. *Ampelis garrulus* LINN. Wax Wing.

Winter visitant; sometimes appearing in vast flocks and not seen again for several years.

94. *Ampelis cedrorum* BAIRD. Cedar Bird.

Common in spring, summer, and, occasionally, in the depth of winter.

95. *Collyrio borealis* BAIRD. Great Northern

Regular winter visitant. Not plentiful. [Shrike.

96. *Collyrio excubitoroides* BAIRD. White-rumped

Summer resident. Not very rare. This species, more common in the autumn, has not been observed here till within the last five or six years. It frequents sandy fields, often taking up its position on a fence post and occasionally dropping down on an unsuspecting cricket. In July last, I saw a pair leading out their young to a hay field for what was probably their first hunt. In general appearance it resembles *C. borealis* but is much smaller, the colours clearer, and is somewhat different in the markings when compared. Arrives April 10th.

97. *Vireo olivaceus* VIEILL. Red-eyed Vireo.

Summer resident. Abundant everywhere in the woods. Arrives first week in May.

98. *Vireo gilvus* BONAP. Warbling Vireo.

Not found in the woods; frequents gardens and shade trees in the city. [catcher.

99. *Vireo solitarius* VIEILL. Blue-headed Fly-

Rare. Observed only in spring. May 10th.

100. *Vireo flavifrons* VIEILL. Yellow-throated Vireo.

Common summer resident. Arrives 2d week in May.

101. *Minus carolinensis* GRAY. Cat Bird.

Common summer resident. Arrives first week in May.

102. *Harporhynchus rufus* CAB. Brown Thrush.

Common summer resident. Arrives first week in May.

103. *Cistothorus palustris* CAB. Marsh Wren.

Abundant in all our marshes during summer. (Short billed species not observed.)

104. *Troglodytes ædon* VIEILL. House Wren.
Common summer resident.
105. *Troglodytes hyemalis* VIEILL. Winter Wren.
Common in spring and fall.
106. *Certhia americana* BONAP. Brown Tree Creeper.
Common resident.
107. *Sitta carolinensis* GM. White-bellied Nuthatch.
Common resident.
108. *Sitta canadensis* LINN. Red-bellied Nuthatch.
Common winter resident.
109. *Parus atricapillus* LINN. Chickadee.
Common resident.
110. *Eremophila cornuta* BOIE. Sky Lark.
Frequent in spring and fall. A few pairs breed.
111. *Hesperiphona vespertina* BONAP. Evening Grosbeak.
A few years ago, T. I. Cottle, Esq., of Woodstock, shot several specimens of this bird in his orchard, in the month of May. They were quite numerous and remained about the place for a day or two. I have heard of their being observed near Hamilton but have not met with them.
112. *Pinicola canadensis* CAB. Pine Grosbeak.
An occasional winter resident. Numerous in some years and none at all in others.
113. *Carpodacus purpureus* GRAY. Purple Finch.
A few resident, the main body being spring and autumn visitants.
114. *Chrysomitris tristis* BONAP. Yellow Bird.
Common resident.
115. *Chrysomitris pinus* BONAP. Pine Linnet.
Winter visitant. Not very numerous.
116. *Curvirostra americana* WILSON. Red Crossbill.
Winter visitant in small flocks. [Crossbill.]
117. *Curvirostra leucoptera* WILSON. White-winged.
Rare winter visitant. Never numerous.
118. *Ægiothus linaria* CAB. Lesser Red-pole Linnet.
Extremely abundant in some winters, rare in others.
119. *Plectrophanes nivalis* MEYER. Snow Bunting.
Regular winter resident.

120. *Plectrophanes lapponicus* SELBY. Lapland Longspur.

Frequently found in autumn in company with the Shore Lark; all those observed at that season are in winter dress, and in general appearance resemble the common Grass Finch. In May last, Mr. Passmore, of Toronto, obtained a fine male specimen in summer plumage.

121. *Passerculus savanna* BONAP. Savannah Sparrow.

Summer resident. Frequents moist fields. Not very numerous. Arrives first week in May.

122. *Poocetes gramineus* BAIRD. Grass Finch.

Abundant summer resident. Breeds in the fields everywhere. Arrives first week in April. [Sparrow.

123. *Coturniculus passerinus* BONAP. Yellow-winged
Rare summer visitant. Only one specimen found.

124. *Chondestes grammacus* BONAP. Lark Finch.

A pair of these birds were observed in May, 1862. The male was obtained. [Sparrow.

125. *Zonotrichia leucophrys* SW. White-crowned
Spring and autumn visitant. Not very rare.

126. *Zonotrichia albicollis* BONAP. White-throated
Sparrow.

Spring and autumn visitant. More plentiful than the preceding. Arrives April 25th.

127. *Junco hyemalis* SCLATER. Snow Bird.

Resident. Most numerous in spring and fall. A few pairs breed.

128. *Spizella monticola* BAIRD. Tree Sparrow.

Common winter resident. Not known to breed.

129. *Spizella pusilla* BONAP. Field Sparrow.

Summer resident. Not numerous. Arrives April 10th.

130. *Spizella socialis* BONAP. Chipping Sparrow.

Summer resident. Abundant in the fields and city.

131. *Melospiza melodia* BAIRD. Song Sparrow.

Common summer resident. Arrives March 12th.

132. *Melospiza palustris* BAIRD. Swamp Sparrow.

Common summer resident. Breeds in marshy situations.

133. *Passerella iliaca* Sw. Fox-coloured Sparrow.
Rare in spring and fall. [beak.

134. *Guiraca ludoviciana* Sw. Rose-breasted Gros-
Summer resident. Generally distributed in open
woods. Arrives second week in May.

135. *Cyanospiza cyanea* BAIRD. Indigo Bird.
Common summer resident. Arrives 2d week in May.

136. *Pipilo erythrophthalmus* VIEILL. Ground Robin.
Common summer resident. Arrives first week in May.

137. *Dolichonyx oryzivorus* Sw. Bobolink.
Common summer resident. Arrives 2d week in May.

138. *Molothrus pecoris* Sw. Cow Bunting.
Abundant resident, a few males frequently remaining
during winter, roosting above the cattle in cow houses.

139. *Agelaius phoeniceus* VIEILL. Red-winged
Blackbird.

Abundant summer resident. Arrives April 10th.

140. *Sturnella magna* Sw. Meadow Lark.
Common; resident, a few remaining during winter in
sheltered situations.

141. *Icterus spurius* BONAP. Orchard Oriole.
Although this species is quite common in New York
and Pennsylvania, I am only aware of one specimen being
found in Canada; the Lakes apparently forming a barrier
to its progress northward.

142. *Icterus baltimore* DAUD. Baltimore Oriole.
Common summer resident. Arrives 2d week in May.

143. *Scolecophagus ferrugineus* Sw. Rusty Grackle.
Spring and autumn visitant.

144. *Quiscalus versicolor* VIEILL. Crow Blackbird.
Common summer resident.

145. *Corvus carnivorus* BARTRAM. Raven.
Frequents the Chatham flats; saw several there in the
spring of 1865. One shot near Hamilton in the fall of 1863.

146. *Corvus americanus* AUD. Common Crow.
Abundant resident.

147. *Cyanura cristata* Sw. Blue Jay.
Common resident.

148. *Perisoreus canadensis* BONAP. Canada Jay.

I have never heard of the Canada Jay being found west of Lake Simcoe. It has been met with near Oshawa.

149. *Ectopistes migratorius* Sw. Wild Pigeon.

Has not been numerous for the last five or six years. A few scattered flocks seen every spring.

150. *Zenaidura carolinensis* BONAP. Wild Dove.

Not very common. A few pairs breed. Has been found at Salt Springs in winter.

151. *Meleagris gallopavo* LINN. Wild Turkey.

Common along the western frontier.

152. *Tetrao canadensis* LINN. Spruce Partridge.

The habitat of this species is the dense spruce forests to the north and east of us. I have seen it exposed in the market with the Ruffed Grouse, but its occurrence so far south is by no means common.

153. *Cupidonia cupido* BAIRD. Prairie Hen.

I can mention this species only as an occasional visitor on the western frontier, a few individuals being occasionally observed along the banks of the St. Clair river but not farther east than I have heard of.

154. *Bonasa umbellus* STEPH. Ruffed Grouse.

Common resident.

155. *Ortyx virginianus* BONAP. Quail.

Common resident.

156. *Grus canadensis* TEMM. Sand-hill Crane.

Summer resident along the shores of Lake St. Clair. Stragglers occasionally seen further east.

157. *Herodias egretta* GRAY. White Heron.

Has been taken at Long Point, Sarnia, and seen near Hamilton. Rare.

158. *Ardea herodias* LINN. Great Blue Heron.

Common summer visitant. Very seldom found in full adult plumage.

159. *Ardetta exilis* GRAY. Least Bittern.

Common summer resident.

160. *Botaurus lentiginosus* STEPH. Bittern.

Abundant summer resident.

161. *Butorides virescens* BONAP. Green Heron.

Very rare. Only one specimen procured.

162. *Nyctiardea Gardeni* BAIRD. Night Heron.
Common in certain localities ; not generally distributed.
163. *Ibis Ordii* BONAP. Glossy Ibis.
A pair shot near Hamilton in May, 1857.
164. *Charadrius virginicus* BORCK. Golden Plover.
Spring and autumn visitant, in small flocks.
165. *Ægialitis vociferus* CASSIN. Kildeer Plover.
Summer resident. Not numerous.
166. *Ægialitis melodus* CAB. Piping Plover.
Rather rare. Several specimens procured near Toronto
by Mr Passmore. [Plover.
167. *Ægialitis semipalmatus* CAB. Semipalmated
Spring and autumn visitant. Common.
168. *Squatarola helvetica* CUV. Black-bellied Plover.
Spring and autumn visitant. Not numerous.
169. *Streptilas interpres* ILLIG. Turnstone.
Common in spring and fall for a short time.
170. *Recurvirostra americana* GM. American Avoset.
Three specimens procured by Mr. Passmore, near To-
ronto, in 1864. It has also been found at Rondeau, on the
shore of Lake Erie. [Phalarope.
171. *Phalaropus hyperboreus* TEMM. Northern
Rather rare ; occasional in the fall.
172. *Philohela minor* GRAY. American Woodcock.
Common summer resident.
173. *Gallinago Wilsonii* TEMM. English Snipe.
Abundant in spring and fall. [Snipe.
174. *Macrorhamphus griseus* LEACH. Red-breasted
Rather rare ; occasional in spring.
175. *Tringa canutus* LINN. Robin Snipe.
Occasional in spring. [piper.
176. *Pelidna americana* COUES. Red-backed Sand-
This is the Black-heart Plover of sportsmen. It arrives
from the south regularly about the Queen's birth-day (May
24th), and sometimes in such numbers as to afford good
sport on that holiday. I have known seventy-six knocked
over with two barrels, they were ranged on a partially sub-
merged log near the water edge, and at such an angle with
the position of the gunner that scarcely a bird escaped.

177. *Actodromas maculata* CASSIN. Jack Snipe.
Common in spring and fall.
178. *Actodromas minutilla* COUES. Least Sandpiper.
Abundant in spring and fall.
179. *Calidris arenaria* ILLIGER. Sanderling.
Common in spring and fall. [piper.]
180. *Ereunetes pusillus* COUES. Semipalmated Sand-
Abundant in spring and fall.
181. *Gambetta melanoleuca* BONAP. Tell Tale.
Occasional in spring and fall.
182. *Gambetta flavipes* BONAP. Yellow Legs.
Common in spring and fall. [piper.]
183. *Tringoides macularius* GRAY. Spotted Sand-
Summer resident. Abundant.
184. *Actiturus Bartramius* BONAP. Field Plover.
With us the Field Plover is by no means common; the
few I have observed, seemed to frequent open downs or
sheep walks.
185. *Limosa fedoa* ORD. Marbled Godwit.
Not very rare in spring and fall.
186. *Limosa hudsonica* SW. Hudsonian Godwit.
More frequent than the preceding. [Curlew.]
187. *Numenius longirostris* WILSON. Long-billed
Rare visitant in spring and fall. [Curlew.]
188. *Numenius hudsonicus* LATHAM. Hudsonian
More common than the preceding; spring and fall.
189. *Rallus crepitans* GM. Clapper Rail.
Occasionally found near Hamilton; more common at
Baptiste Creek, where it breeds.
190. *Rallus virginianus* LINN. Virginia Rail.
Common summer resident.
191. *Porzana carolina* VAILL. Common Rail.
Abundant summer resident.
192. *Fulica americana* GMELIN. Coot.
Breeds by thousands along the marshy shores of Lake
St. Clair; not uncommon in other parts of Canada. Have
killed ten with one barrel in Burlington Bay.
193. *Gallinula galeata* BONAP. Florida Gallinule.
Common, but not so abundant as the preceding: fre-
quents similar situations.

194. *Cygnus americanus* SHARP. American Swan.
Spring and fall visitant.

195. *Anser hyperboreus* PALLAS. Snow Goose.

Of frequent occurrence; mostly in the blue state of plumage.

196. *Anser frontalis* BAIRD. Brown-fronted Goose.

I have a specimen of this goose which was killed on the St. Clair flats during the last week of October, 1866. It has been observed in former seasons but only in small numbers.

197. *Bernicla canadensis* BOIE. Canada Goose.

Large migratory flocks pass over in spring and fall; occasionally a few alight on our Bay and frequently pay the usual penalty for so doing.

198. *Bernicla brenta* STEPH. Brant.

The Brant Goose is frequently killed in spring and fall at Baptiste creek at which point the line of their migratory course seems to be Northeast and Southwest.

199. *Anas boschas* LINN. Mallard.

Breeds abundantly in our western marshes.

200. *Anas obscura* GM. Black Duck.

Common at all the shooting stations.

201. *Dafila acuta* JENYNS. Pin Tail.

Rather common.

202. *Nettion carolinensis* BAIRD. Green-winged Teal.

Large flocks visit our Bay in spring and fall.

203. *Querquedula discors* STEPH. Blue-winged Teal.

Breeds in western marshes. Abundant.

204. *Spatula clypeata* BOIE. Shoveller.

Breeds in western marshes. Common.

205. *Chaulelasmus streperus* GRAY. Gadwall.

Rather rare.

[geon.

206. *Mareca americana* STEPHENS. American Wild-Common.

207. *Aix sponsa* BOIE. Summer Duck.

Abundant. Breeds all over the country. Most plentiful in the west.

208. *Fulix marila* BAIRD. Broad Bill.

Common.

209. *Fulix affinis* BAIRD. Blue Bill.
Extremely abundant in the spring and fall.
210. *Fulix collaris* BAIRD. Ring-necked Duck.
Rather common.
211. *Aythya americana* BONAP. Red Head.
Abundant in spring and fall.
212. *Aythya vallisneria* BONAP. Canvass Back.
Stragglers found in company with preceding species.
213. *Bucephala americana* BAIRD. Golden Eye.
Common winter resident.
214. *Bucephala albeola* BAIRD. Butter Ball.
Common in spring and fall.
215. *Harelda glacialis* LEACH. Long-tailed Duck.
Common winter resident.
216. *Melanetta velvetina* BAIRD. Velvet Duck.
Abundant in our bay for a few days during May.
217. *Pelionetta perspicillata* KAUP. Surf Duck.
Rather rare. Occasionally found in company with the preceding.
218. *Somateria mollissima* LEACH. Eider Duck.
The young are frequently obtained late in the fall. Adult not observed.
219. *Erismatura rubida* BONAP. Ruddy Duck.
Rather common in spring and fall.
220. *Mergus americanus* CASSIN. Goosander.
Not very rare.
221. *Mergus serrator* LINN. Red-breasted Merganser.
Not very rare. [ganser.
222. *Lophodytes cucullatus* REICH. Hooded Merganser.
More plentiful than either of the two preceding species.
223. *Pelecanus erythrorhynchus* GM. American Pelican.
Two individuals were shot in our bay in May, 1864.
224. *Sula bassana* BRISS. Solan Goose.
Has been found in the bay, much exhausted, after strong easterly winds.
225. *Graculus carbo* GRAY. Common Cormorant.
Accidental in spring and fall.
226. *Graculus floridanus* BONAP. Florida Cormorant.
This species was first observed in our bay in the spring

of 1864, and a second specimen was killed in May of 1865. The first obtained I imagined to be a small specimen of *G. carbo*, the other, however, also agrees with the measurements given of *G. floridanus*.

227. *Stercorarius pomarinus* TEMM. Pomarine Skua. Common during winter around the Bay Shore.

228. *Larus marinus* LINN. Great black-backed Gull. Common in winter. Follows the fishing boats but always at a safe distance.

229. *Larus Smithsonianus* COUES. Herring Gull. Common in winter.

230. *Chrococephalus Franklinii* BRÜNN. Franklin's Rosy Gull.

An individual of this species was killed on the Bay in October 1865. [Gull.]

231. *Chrococephalus philadelphia* LAWR. Bonaparte's. Rather common in spring and fall.

232. *Thalasseus caspius* PALLAS. Caspean Tern. Var. *imperator* COUES.

A few seen in spring and fall.

233. *Sterna hirundo* LINN. Wilson's Tern. Abundant in spring and fall.

234. *Hydrochelidon fissipes* GRAY. Short-tailed Tern. Breeds in western marshes. Abundant.

235. *Colymbus torquatus* BRÜNN. Loon. Common.

[Diver.]
236. *Colymbus septentrionalis* LINN. Red-throated. Abundant in spring in immature plumage; the adult very rare.

237. *Podiceps Holbölli* REINH. Red-necked Grebe. Spring and summer visitant.

238. *Podiceps cornutus* LATHAM. Horned Grebe. Common. A few breed.

239. *Podilymbus podiceps* LAWR. Dab Chick. Rather rare.

240. *Uria grylle* LATHAM. Guillemot.

Has been taken in our bay after strong easterly storms.

241. *Uria lomvia* BRÜNN. Foolish Guillemot.

Found under circumstances similar to the preceding.

sexual organ; and I saw, being conveniently situated for observing, the palp, from which a horny white body of changing figure was drawn out, penetrate many times; and I saw also, the spider use alternately, now one and now another of the palpi. But I saw also with surprise and indignation that, the work hardly finished, the male not being able to fly on account of the confinement, the female enveloped him in her threads and, having thus deprived him of every means of defence, devoured him. Perhaps overpowering hunger compelled her to it, but the act was very ferocious.¹³ Whatever were the results, this observation gave me an opportunity of seeing the sexual organs of both spiders. The generating palp of the male appears through the microscope as in fig. 2 at *a* and at *b*. The (anterior?) extremity of the abdomen of the female is drawn in two aspects in fig. 3, the upper side at *a* and the under side at *b* in the form of an elongated tube, a form which I have observed in some flies and in a few other insects, which, while it aids to a more sure fertilization, serves also for conveniently placing the eggs.

Sexual organs, not precisely similar, but analogous to these described, I have observed in other species of spiders, which I will here describe briefly, as I have many times observed them, giving also exact drawings from life. Fig. 4 represents the *marmorata* spider (*Aranea marmorea* L.), as useful as the *diadema* spider, whose habits it shares to some extent. The cocoon is whitish and is found under planks and in garden vases. The feminine part is represented by fig. 5, and the male by fig. 6, where it is shown drawn out by pressure: *a* is the sheath which encloses and protects it; from the opening *b* issues a tuft of hair, the use of which I know not, and many hairs are seen around the sexual parts of both. Figures 7 and 8 represent the back and abdomen of a pretty female spider (*Aranea speciosa* di Pallas) which frequents hedges. It spins a web near the ground,

13. But I ought to say that I have not found other spiders so ferocious. The *Aranea cucurbitina* remained with his companion in a little box the entire season, and if I gave them a fly, instead of quarrelling over it, they ate it together peaceably.

which, beside being circular, has in its midst a zigzag band, which traverses it from top to bottom. This spider is a little larger than the *diadema*. The abdomen of the female is of a very brilliant yellow, contracted near the corslet where there is a little of a silver color, and it has about ten black bands somewhat slashed. Fig. 9 represents the male of the same species, much smaller than the female. Its color is the same, but the marks caused by the folding of the skin of the abdomen, are more confused. The palpi are larger, and terminated by a somewhat oval protuberance. Fig. 10 represents the palpi closed; fig 11 shows all the internal provision for extending itself out with compression. In fig. 12 is seen the sexual part of the female, superior at *a*, inferior, that is toward the abdomen, at *b*. Being compressed, it appears to extend itself out, divided into two lobes (fig. 13, *a* and *b*), but in a side view it has the figure *bb*, and is seen tulla uncinata (held grappled). The structure of the cocoon of this spider is also to be seen represented in fig. 14. Villiers,¹⁴ I know not why, represents the spider, under the name of *Aranca formosa*, much smaller than the cocoon, but I have represented both of their true dimensions. It (the cocoon) is found covered with a gum easily soluble in warm water, but insoluble in cold. The floss, which projects upon the upper part, serves to attach it to the bodies under which the spider conceals it. In fig. 15 is seen the same cocoon split open, and it is to be observed that the receptacle for the eggs is in the middle, surrounded by yellowish silk, and in the centre, of the color of coffee, protected on all sides from destructive insects and from water.

The female of the *zucca* spider (*Aranca cucurbitina* L.) is represented in fig. 16, and in fig. 17 the male. In fig. 18 is seen one of its palpi, closed at *a*, and on the side at *b*, looking toward the concave part at *c*, elongated, and at *d* entirely stretched out during compression. Fig. 19 shows the sexual part of the female. This spider forms small and yellowish cocoons.

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Fig. 20 represents the female of the *coronata* spider (*Aranea corollata* L.) and fig. 21 its sexual part. I have not yet seen its cocoons.

Fig. 22 is the male of the *conica* spider (*Aranea conica* L.). One of its palpi compressed, and thus showing how much it internally contains, is seen in fig. 23. Fig. 24 shows the generating organs of the female, of a singular structure. Fig. 25 represents the same organs in the female of the *domestic* spider (*Aranea domestica* L.) I gave in 1788¹⁵ a figure of the palp of the male, although I was not then sure that this was its instrument of generation. Little advantage can be drawn from winding the silk of its cocoons, but it is excellent for staunching blood from wounds.

We may collect from the preceding observations upon the generation of spiders, that the males are few in comparison with the females. The males may, moreover, be distinguished from the females by superficial observers by a mere inspection of the palpi, which are small in the latter and large in the former. Let all the spiders be examined which may fall under the eye, and none excepting females will be found until July. If the males are many and equal the females in number, where are they? how do they feed themselves? At the time of their amours, there are very few, or at least very few are seen, and if there were many of them they would be seen to run in crowds where love, pleasure and the necessity of reproducing draw them.

How then, it will be said, are so few males sufficient to fertilize so many females, especially since they require a long and perilous ceremonial before coming to the fertilizing act? Every one knows that this is not new in nature; but, to get rid of every improbability, I will bring forth two observations made and many times repeated by me.

The first is that not all the cocoons contain fertile eggs, since, in fact, I had a few from which the little spiders never came out; a proof that the female spider had laid the eggs without coupling, as many insects, reptiles, and even birds do.

Secondly, I have observed that the eggs of spiders are sometimes found fertile without any previous conjunction.

15. *Opuscoli scelti.* Vol. I, page 49.

I know that this is not the common course of nature, but I know also that the phenomenon is not altogether new. Why may it not occur in regard to the eggs of spiders? The fact is certain, many times verified by me, and I will report here a single observation, well circumstantiated. In 1791, at the time of their amours, I went in search of female spiders, and I found fourteen of them, together with the male, and I was witness of their conjunction. I collected them separately in the usual boxes, where they all gave me, some one, some two cocoons. In the spring, the little spiders came out from the cocoons, and from their littleness escaped through the net-work by which the box was closed on two sides. Four of the mother-spiders perished during the winter and ten remained, more than enough for my object. These were abundantly fed on flies which they devoured greedily.¹⁶ In the early part of May, 1792, they began one after another, to form cocoons. In the middle of the month, the cocoon, white before, became blackish, a sign that the little spiders were hatched, nor did they delay coming out from the cocoon and from the box in which the mother remained. On the first of June and thereabout the mothers produced a second cocoon, nearly equal to the first, and from this also, the little spiders went out, well formed and lively, without having followed upon any coupling. The mothers made the third cocoon between the first and the sixth of July, and the little spiders were hatched in the same manner and ran away. The same thing occurred with a fourth cocoon, made between the 17th and 24th of August, and also with a fifth formed between the 30th of the same month and the sixth of Sep-

16. I say "devoured" because the spider does not content himself with sucking the fluids of his prey, but he tears it, swallows the flesh, rejecting with excrements the parts difficult of digestion, which are the wings, claws, &c. Lister observed this in one spider, and I have observed it in very many; having also assured myself of it by soaking in warm white wine the dead bodies of insects offered for the spider's meal. I saw that among the members which recovered their natural dimensions many pieces were missing.¹

1. This was at the best *negative* proof, and it seems very doubtful whether spiders really swallow anything but fluids, though they crush and comminute the hard parts to obtain their soft contents. [REVISER.]

tember, and a sixth between the end of September and the middle of October. The only difference between the broods was that the last had less silk and fewer eggs than the first. It follows from all this, that the spiders produce many cocoons in a year, generally six; that females are able to produce fertile eggs without being every time fecundated, and that consequently the number of males may be, as in fact it is, much less than the number of females.

The discovery that the act of coupling, fecundated through six generations of eggs, the following year, appeared to me, and indeed was, a very important thing. I wished to learn if it was altogether new, and among the many entomologists that I have read, I have never seen any mention made of it excepting by Martin Lister, who did not, however, determine either the time or the number of fruitful cocoons formed without coupling. No other writer has a word on the subject.

In order still further to assure myself, and at the same time to see if the fertilization could be protracted beyond the year, I wished to preserve the same spiders in the winter, but three of them perished. Of the seven remaining, I gave one to P. Carlo Giuseppe Campi Somasco, an accomplished and very accurate naturalist.¹⁷ He kept it so well that between the months of May and June it produced a cocoon twice, from which little spiders were hatched. The spiders in my possession were also found to remain fertile, and those which lived till October remained fertile even to the sixth cocoon. Three had perished in the summer, some after the third, and some after the fifth. The four remaining died in the winter. In this way spiders fertilized three years before gave as many as eighteen cocoons without any preceding coupling. I do not know through how many years the fertilization may be extended; but it is not im-

17. To him is due the first thought of the *Scelta d'Opuscoli interessanti* (collection of interesting pamphlets), commenced in 1775. His poor health did not permit him to coöperate in this work after 1777. But he did not, for this reason, neglect to occupy himself with useful researches. He died in 1799 at the age of 66.—Editor.

m. It is not stated who this editor was. (REVISER.)

probable that one conjunction alone may suffice for their whole life, which is usually from four to five years.

Where they pass the winter is not yet well determined. Some *diadema* spiders I have found enveloped by their threads with dried leaves; others at the top of cellars or attics, and some *domestic* spiders in coverings of old webs, but these are very few in comparison with those which we see reappear in the Spring.

It follows from all this that there are few male spiders in comparison with the females, and that few in fact are needed, one conjunction alone being sufficient for many years, and perhaps for the whole life of the female.

It will not be out of place to observe here that although a few species of spiders always carry with them the sack of eggs generated by them, until the spiders appear, yet in general they are contented with suspending it in a place protected from the sun and from water, and as far as possible from enemies, and although some remain for hours and others for entire days upon the fresh cocoon, full and perfect, yet it should not be said that they hatch the eggs as birds generally do.

There is not, as far as I know, any other insect which forms a silky cocoon, in which to deposit its eggs, like the spider, if we except that great black beetle (*Scarabæus*) which is found in the water, and is thence called *Idrofilo* (lover of water), (*Datyscus piceus* Lin). It makes a cocoon of fine white silk, smooth below with a protuberance above, and this is seen floating full of eggs upon stagnant or slowly running water. The little beetles, when they have come out from the eggs, open for themselves a door in the upper part, hop out, and are soon briskly swimming about in the water, their native element.

NOTE. On page 74, speaking of the *Aranea formosa*, for the sake of brevity its cocoon is not described with all precision; beside what is noted, it is remarkable that among the fine silk which fills the cavity of the cocoon, there is in the interior a mass of pyramidal silk. The top is of a fine coffee color, and the base is of more compact silk in a semicircular form. If this is drawn out gently with the fingers, a little plate (*patina*) of gummed silk is

seen united to the threads of the base, which is the covering of a silky tuft, to which it fits perfectly, and in which is the future family, that is, the eggs and then the little spiders, which know how to go out at the proper time without disordering the internal architecture. The rest of the silk which does not serve to form the pyramid is yellowish and can be used with advantage.

NOTE TO REVISER'S PREFACE. This work was purchased for the Astor Library in April, 1853, by Dr. J. G. Cogswell, who was then Librarian.

I desire here to express my sense of very great obligation to Dr. Cogswell and also to Frank Schroeder, Esq., the present Librarian, for the unusual facilities and the ready assistance afforded me in preparing the copy and this translation.

Dr. Cogswell remembered the title and contents of the work as soon as it was mentioned to him, and we must attribute its having remained so long unnoticed by others, partly to its small size in comparison to the large number of other works on Arachnidæ which the Astor Library contains, and to its being in a language with which comparatively few are familiar, but chiefly to the lack of interest in the subject of spiders' silk.

B. G. W.

V. *List of Birds observed near Hamilton, Canada West.*

By T. McILWRAITH.

[Communicated Aug. 2, 1866.*]

The following list has been prepared chiefly from observations made by the writer during occasional excursions extending over a period of ten years. Those acquainted with the subject will understand that under these circumstances it is not likely to be complete, as from the real scarcity of many species and the short stay made by others while on their migratory course, it is not probable that all the species of birds which visit this locality have been observed by one individual during the time mentioned. As the number of collectors increase, and greater interest is taken in the subject, there is no doubt but many species, which have hitherto escaped observation, will be added to the list.

* This paper was received in June, 1865, but has been unavoidably delayed.—EDITOR.

Hamilton is too far inland to be visited by many of the shore birds. Burlington Bay, however, with its sandy beach and marshy inlets, affords a fair field for the collection of such birds as frequent those situations. Ducks are also well represented, though, on account of the increase in navigation of late years, they are more disturbed and are not so numerous as formerly.

Care has been taken not to include in the list any species about the occurrence of which there is the least doubt.

1. *Cathartes aura* ILL. Turkey Buzzard.

The Turkey Buzzard is seldom seen near Hamilton. At the extensive flats near Chatham and along the shore of Lake St. Clair it is a regular summer visitant. In that district herds of cattle graze at large and putrid carcasses are not unfrequent, which may account for the partiality of the Buzzard.

2. *Falco anatum* BONAP. Duck Hawk.

Rare near Hamilton, more common at Baptiste Creek, Long Point, and other shooting stations, where it is observed to prey chiefly on that class of birds embraced under the general name of mud-hen. As it is rarely seen except in the fall, it is probable that the young are reared beyond hunting distance of any of those places.

3. *Falco (Hypotriorchis) columbarius* LINN. Pigeon Hawk.

More plentiful than the preceding species. Frequents similar situations and preys largely on Black-birds.

4. *Falco (Tinnunculus) sparverius* LINN. Sparrow Hawk.

Common summer resident. Frequents dry sandy districts. Breeds in holes vacated by Woodpeckers.

5. *Astur atricapillus* BONAP. Gos Hawk.

Rather rare; those procured being mostly in immature plumage.

6. *Accipiter Cooperii* BONAP. Cooper's Hawk.

Not very plentiful. Varies much in size and plumage, with sex and age.

7. *Accipiter fuscus* BONAP. Sharp-shinned Hawk.

Seen in Spring and Fall. Not observed to breed.

VI. *Observations on Polyzoa. Suborder Phylactolamata.*

BY ALPHEUS HYATT.

[Continued from Vol. IV, page 228.]

MUSCULAR SYSTEM.

The specialized muscles are arranged in two ways, as circular bands, or longitudinal bundles. The Sphincter, and a new set which I have called the Brachial Contractors, are in the first series.

The sphincter is very broad in *Fredericella* and in some species of *Plumatella*, forming a cup shaped cavity by its contraction when the orifice is closed over the retracted polypide (Pl. 7, fig. 6, L, Pl. 8, figs. 2, 4, L). In *Pectinatella* and *Cristatella* the breadth of this muscle is much reduced, and the aperture is closed by the contraction of the edge of the orifice, no cup shaped cavity being formed (Pl. 9, figs. 12, 13, Pl. 13, figs. 5, 6, A''').

The brachial contractors are a set of small muscles, ranged on both sides of the interior of the lophophore immediately below the junction of the bases of the tentacles (Pl. 12, fig. 2, L'), and thence they descend on the sides, like the supporting knees of a ship's deck, passing between the bases of the outer and inner tentacular bands. They act directly upon the floors of the arms, which are more or less drawn up into folds by them, and, when the ends of the arms are depressed, these folds become well marked, dividing the cavities by series of ridges rising nearly up to the lophophore.

The second series comprises all the larger muscles of the body.

The three sets of retractors, previously described,* are the instruments by which the principal movements of the polypide are accomplished. These are distinguishable at an early age in the young, and have at all times the local distribution of the posterior attachments which led me to divide them into three sets. Three anterior attachments on either side are sometimes visible when the polypide is

*In general terms on p. 206.

entirely retracted, but their distinctness is produced wholly by the extreme tension of the fibres. Under ordinary circumstances, the anterior attachments are not separable from each other and often single bundles seem to have distinct anterior bases. This is especially the case with the anterior branch of the gastric retractors in *Pectinatella* (Pl. 9, fig. 13, Pl. 10, fig. 1, M.) because of the great size and peculiar deflection of the alimentary canal from the direct line of action of the retractors.

Although this differentiation of the anterior branch of the gastric retractors may be occasionally seen in *Fredericella*, *Plumatella* and *Cristatella* it is not habitual, since the stomachs of the polypides in these genera, usually lie in the same, or nearly in the same plane with the retractors. When, however, complete invagination takes place and the stomach of the polypide shoots past the bases of the retractors, the anterior branch separates from the other retractors and assumes precisely the same aspect in these genera that it habitually has in *Pectinatella*.

The freedom of motion manifested by every minute bundle of fibres is the one great peculiarity of the larger bands. Each bundle has the faculty of acting separately in the gastric retractors, and though this independence is less noticeable in the other retractors, because of the closer association of the bundles, it is still appreciable.

In *Plumatella diffusa* a very singular conjunction of the retractors sometimes takes place. They are brought together on the abdominal side of the stomach, and held there as if bound by a narrow muscular band. The polypide when this conjunction occurs, is bent over towards the abdominal side, and the stomach displaced by the combined muscles.

Dumortier and Van Beneden* recognized the existence of isolated fibres attached to the endocyst at the base of the arms, and Prof. Allman† showed them to be of equal size and value with the internal branches (œsophageal re-

* DUMORTIER and VAN BENEDEN. Op. cit. t. 16, p. 86.

† ALLMAN. Op. cit.

tractors) of the great retractors, although neither saw fit to give them different names.

The gastric retractors keep the stomach in its proper position in the axis of the tube (Pl. 7, fig. 4, Pl. 8, fig. 2, Pl. 9, figs. 12, 13, Pl. 14, fig. 1, M). While the polypide is evaginated these muscles move the digestive organs to correspond with the different positions of the lophophore, always maintaining them in the most favorable posture for the performance of their functions, and guarding against any abrupt curvatures that might otherwise occur during the movements of the polypide. It must be held in mind, also, that they are absolutely necessary in the majority of the *Phylactolaemata* which grow inverted upon the lower surfaces of logs, or other submerged objects. There is no provision whatever in the muscular organization of the alimentary canal enabling it to hold an upright position favorable for the performance of the peristaltic functions. The gastric retractors supply this deficiency, and, also, prevent the stomach when loaded with food, from bearing its whole weight upon the œsophagus and intestine. They, also, send off a few branches to the intestine, but these are rarely seen; and, although probably present in all the genera, I have observed them only in *Fredericella* and *Cristatella* (Pl. 7, fig. 4, Pl. 14, fig. 1).

The part played by the gastric retractors in disposing of the alimentary canal, varies in the different genera. In *Fredericella*, where the end of the stomach seldom passes the anterior terminations of these muscles, they continue the act of retraction; but, in *Plumatella*, they frequently relax again after the stomach reaches their bases, in order that it may pass still further into the cœcœcium. In *Pectinatella*, on the contrary, they do not relax when the invagination becomes more complete, but bind the end of the stomach down between the bases of the retractors. In *Cristatella* they relax again, as in *Fredericella* and *Plumatella*, permitting the stomach to pass in a dorsal direction some distance beyond their bases.

The lowest bundles, attached near the origin of the funiculus, were mistaken by Hancock, for reproductive or-

guns; but they are undoubtedly muscular, as is shown in the figures referred to above. I found them, in all species attached to the stomach above the origin of the funiculus, and in every respect comparable with the other branches of the gastric retractors.

The œsophageal retractors, as regards their posterior fibres, can hardly be separated from the gastric retractors (Pl. 7, fig. 4, Pl. 8, fig. 2, Pl. 9, fig. 12, Pl. 10, fig. 1, Pl. 12, fig. 1, Pl. 14, fig. 1, M'). These filaments attached to the œsophagus, are, however, densely arranged, and whenever the three large muscles can be distinctly seen, as in the younger stages of growth, or in a retracted adult polypide, they invariably form part of the œsophageal retractors. They perform for the œsophageal canal the same office that the gastric retractors effect for the stomach; they hold that organ upright and unbent in its proper place. The mode in which they act is especially remarkable in *Pectinatella*, where they keep the posterior portion of the œsophagus from being suddenly deflected during the process of invagination, and thus protect the delicate membranes immediately around the mouth and nerve-mass from the strain to which they would otherwise be subjected (Pl. 9, fig. 13).

The filaments going to the lophophore diverge in fan-shaped attachments, reaching abdominally more than half way round the œsophagus, and extending more or less dorsally according to the generic rank of the individual, and the greater or less degree of evagination displayed by the evaginable tube.

The brachial retractors do not distribute any filaments to the alimentary canal in their passage from the cœnœcium to the brachial collar of the polypide (Pl. 7, fig. 4, Pl. 8, fig. 2, Pl. 9, figs. 12, 13, Pl. 10, fig. 1, Pl. 12, fig. 1, Pl. 14, fig. 1, M'') differing from both of the other pairs by having all the fibres attached to the endocyst in a uniform manner.

Besides being more especially concerned in producing the invagination of the polypide than any other muscles, these retractors determine the motions of the crest. They

may incline the polypide to the right or left, by reciprocal contraction and expansion on the opposite sides of the body, or sway it towards the abdominal or dorsal sides.

In *Fredericella*, and the *Plumatellidæ* it is necessary for both the œsophagal and brachial retractors to act reciprocally in order to bring about the dorsal or abdominal flexures of the polypide; but in *Pectinatella* and *Cristatella* the brachial retractors are probably sufficient by themselves. The diffusion of the filaments of the brachial retractors is so great in these genera, that those on the abdominal or dorsal sides would have sufficient leverage and be fully competent to bend the polypide either forwards or backwards.

The muscles of the invaginated fold are in two sets. These have been previously described by Prof. Allman under the names of Posterior and Anterior Parieto-vaginal muscles; but, since I differ from him in the location of the poles of the body, I have thought it advisable to alter these names in order to avoid confusion. The first set or Anterior Retentors, equivalent to the posterior parieto-vaginals of Allman, consists of a single annular row attached to the lower edge of the invaginated fold (Pl. 7, figs. 4, 5, Pl. 8, figs. 2, 5, Pl. 9, fig. 12, Pl. 10, fig. 1, Pl. 13, fig. 5, Pl. 14, fig. 1, N).

The second set, or Posterior Retentors, equivalent to the anterior parieto-vaginal muscles of Allman, consists of smaller muscles attached to the side of the invaginated fold (Pl. 7, fig. 4, Pl. 8, figs. 2, 5, Pl. 10, 12, fig. 1, N').

The latter are not, as has been hitherto supposed, irregularly disposed, but are arranged in rows, the bundles being placed alternately in each row. They assist the anterior retentors to retain the invaginated fold, and sustain the tentacular sheath in the centre of the cœnœcium, when the polypide is retracted. Deep external furrows are often caused in the cœnœcium by these posterior retractors, while the polypide is fully expanded (Pl. 8, fig. 5, N'). Similar folds were, also, noticed in the polypidal endocyst of *Pectinatella* occasioned by a few fibres, probably abnormal, which connected the œsophagus and oppo-

site wall (Pl. 11, fig. 1, R). These were few in number, and were seen only in one specimen on the abdominal side.

There is a highly interesting series of muscles described by Dumortier and Van Beneden in the cœcnœcium of *Fredericella*, called by them "Short Retractors," which resemble these. They are attached to the alimentary canal, and bear about the same relation to the stomach that the abnormal fibres of *Pectinatella* do to the œsophagus (Pl. 11, fig. 1, R). These reticulating fibres dispersed throughout the interior bear a certain likeness to the network of muscles in the cœcnœcium of *Cristatella*. They differ materially, however, in having the posterior extremities attached to the alimentary canal instead of to the upper walls of the cœcnœcium.

In the lophophore there is a pair of large muscles, one in each arm, which I have called the Lophophoric Flexors (Pl. 13, fig. 13, M). They arise from the oral region, and proceed on either side to the extremities of the arms, buried in the substance of the lophophore, and bordered on their outer sides by the nerves. They elevate the tips of the arms, or bend them in an anterior direction.

The agency of a pair opposing the lophophoric flexors is recognizable every time the tips of the arms are bent anteriorly, but no bands of fibres were observed in the floor of the arms, which could have caused these movements. The lophophoric flexors have been described and figured by Dumortier and Van Beneden as a fascicle of the retractors.* This, however, I believe to be erroneous, since, in *Pectinatella* and *Cristatella*, the œsophagal retractors, although attached to the inside of the arms for some distance in advance of the mouth, do not mingle their fibres with, or approach those of the flexors in the centre of the arms, but terminate on the sides just below the bases of the tentacles.

By all other authors, who have seen them, they have been confounded with the lophophoric nerve-branches.

* Op. cit. p. 86. pl. 4.

The peculiar elevation of the arms, however, indicates the presence of a muscle which can only be situated in the plane of the lophophore and attached at its two extremities respectively near the tips of the arms, and in the vicinity of the oral aperture. Just before entering the cœnœcial cell they are thrown up posteriorly and after emerging therefrom frequently sustain this position for a considerable time, which would not be possible without the aid of strong muscles situated in the ceilings of the arms in a position similar to that ascribed to the lophophoric flexor. The great expansion of the bases of the flexors around the mouth and the coarseness of the fibres, also indicate a muscular rather than a nervous tissue. Finally I have been able to trace a continuous filament for some distance in the arms and on the outer borders of these bands, from which alone arise the nervous filaments, branching off to the bases of the tentacles.

Thus, although not so fortunate as to detect the intimate structure of their tissues, or to see them in action, I have but little doubt that the bands inclosed between the branches of the lophophoric nerve-trunks are muscular (Pl. 13, fig. 13, M).

The outer Tentacular Bands line the sides of the tentacles, two bands to every tentacle (Pl. 11, fig. 1, Pl. 12, fig. 2, Pl. 13, fig. 15, Pl. 14, fig. 1, O). Starting in pairs from the sides of the brachial contractors below the bases of the tentacles, they continue to within a short distance of their ends, and there spread out in fan shaped attachments. These attachments joining in each tentacle, when contracted, form an annular constriction, which gives a peculiar swollen, or club like aspect to the sensitive tips (Pl. 14, fig. 7). The fibres of the opposite bases on the sides of the brachial contractors also intermingle, and the spaces between, not being obscured by the fibres of these bands or the thickness of the contractors themselves, are much thinner and comparatively clear. Besides these there are inner Tentacular Bands consisting of numerous fibres descending from the inner sides of the tentacles, and running in parallel lines along the floor of the arms toward the per-

igastric cavity (Pl. 11, fig. 1, Pl. 12, fig. 2, Pl. 13, fig. 15, O'). They divide near the bases of the arms into two broad bands, accompanying the clear tentacular spaces across the bend of the "horse-shoe" and around the œsophagus. The outer tentacular bands incline the tentacles outwards, or sidewise, the inner tentacular bands bend them towards the centre of the lophophore.

The epistome is provided with three interior muscles, a small central muscle on the side next to the mouth, and two larger ones on the opposite or dorsal side (Pl. 11, fig. 1, Pl. 13, fig. 14, P, P'). The former has its base close to the œsophagus, and is attached by the posterior extremity to the inner side of the border of the epistome on the median line, the base and attachment being quite broad and of about equal size. The two latter have their bases fixed to the lophophore close to the roots of the tentacles, thence they spread in fan shaped masses on either side, sending muscular bundles to nearly the whole of the inner surface of the border of the epistome. The single median muscle produces the ordinary jerking action of the epistome, and the two lateral muscles elevate it, or modify the outline of the border. These muscles are figured as one by Prof. Allman, probably owing to his having viewed them laterally, mistaking the two lateral bands for a single muscle, and overlooking the median band which in most lights is not visible from the side.

NERVOUS SYSTEM.

Viewed from the dorsal side, the nerve mass of *Fredericella* is irregularly elliptical, or orbicular, and when expanded, lies flat against the œsophagus (Fig. 9). When contracted the anterior is drawn up in close proximity to the posterior end, giving the peculiar heart-shaped or rotund aspect, from the side, which has been previously described and figured by Dumortier and Van Beneden, and Prof. Allman in *Fredericella sultana*.* Hancock, how-

* DUMORTIER and VAN BENEDEN. Op. cit. Nouv. Mem. Acad. de Bruxelles, Tom. 16. Complement pl. 8. ALLMAN. Op. cit. pl. 9.

ever, observed and figured it when expanded and having the peculiar spindle-shape represented below in Figs. 10 and 11. The contraction of the nerve-mass in *Fredericella* invariably takes place on the ventral side and towards the posterior end, and when in this state it is generally removed to some distance from the œsophagus. These movements of contraction and expansion occur very irregularly, and often when the former happens, the entire mass is drawn up into the cavity of the epistome. This generally precedes the invagination of the polypide in *Plumatella*, and the epistome, in all other genera, doubtless serves, while within the cœncecial cell, to protect the nervous centres from compression by the surrounding membranes. During the confinement of the polypide in the cell, the epistome lies in the hollow formed by the overarch-ing bases of the tentacles, and is admirably fitted to receive and guard them from injury. No muscles were detected in connection with the nerve-mass, which could have been instrumental in occasioning either the contractions or the subsequent elevation of this part into the cavity of the epistome.

Notwithstanding its mutability there is every reason for regarding this body as a true nerve-mass. The numerous branches from the sides, the angular junctions of these with the main body, and the evident solidity of the whole, leaves no doubt of its nervous nature. The principal nerves spring from the sides (Fig. 9), and are divisible into anterior and posterior sets according to their places of origin. The posterior set comprises the nerves distributing themselves to the epistome lophophore, tentacles and evaginable endocyst, and the anterior set those which go to the various parts of the alimentary canal. For convenience sake I have designated the larger branches and their smaller ramifications, respectively, by the names of nerve-trunks, and nerve-branches. The anterior set all arise from four large nerve-trunks near the posterior end of the nerve-mass, two on either side (Figs. 10, 11). Two of these, the branches of which are unknown, supply the epistome, and, perhaps, the oral portion of the œsophagus. They are trace-

able to the base of the epistome, but are then lost to view in the thickness of the endocyst (Figs 10, 11, T').

The remaining pair, the Lophophoric Nerve-trunks, are placed somewhat more to the dorsal side, but have confluent bases with the corresponding Epistomic Nerve-trunks. They divide into four branches, two on each side, one pair going obliquely and dorsally to the lophophore and the others in an anterior direction to the evaginable endocyst on the dorsal side (Figs. 9, 10, 11, T'''). The lophophoric branches separate squarely when they reach the lophophore into four smaller branches (Figs. 9, 10, 11, U). Two of these, the Oral Branches, pass abdominally, each one half way round the oral aperture throwing off filaments to the bases of the tentacles, and finally terminate in two tentacular filaments, which are lost at the junctions of the base of the central tentacle with the adjoining sides of the approximate tentacles (Pl. 15, fig. 1, U'). The remaining pair, the Brachial Branches, are much shorter, in consequence of the round outline of the lophophore. They traverse the lophophore in a dorsal direction giving off filaments to the few tentacles on that side, and terminate, also, in two tentacular filaments, at the junction of the median pair of tentacles behind the epistome.

The nervous filaments disappear at the junction of the bases of the tentacles, and cannot be traced into them, but each one probably splits into two branches which climb the approximate sides of every pair of tentacles, one branch on either side. On the dorsal side, however, where the basal junction of the central pair of tentacles comes directly upon the median line, this mode of distribution is violated. There are two filaments, respectively the ultimate nervules of the right and left brachial branches, which come together, and must be distributed at this single, median junction. They, however, do not appear to enter the cavity of the tentacles, but cross them to the opposite sides from which they came and distribute themselves to the approximate sides of the pair.

The anterior branch, or Polypidal Nerve-branch, strikes off abruptly from the main trunk (Figs. 9, 10, 11, T'''),

and goes to the evaginable endocyst on the dorsal side. The range of individual variations in the principal branches may be estimated from figures 9, 10 and 11. They were taken from different zooids on one colony of *Fredericella regina* collected at Gorham, Maine, figs. 9 and 10 being from the same zooid. In fig. 11, the main lophophoric trunk divides close to its base, in figs. 9 and 10 the division is somewhat higher, in fig. 11, also, the lower part of the trunk is much more distinct from the epistomic nerve than in fig. 10, where they run together in one common base. The polypidal branch of fig. 9 entered the evaginable endocyst a very little above and to the left of the anal orifice, while that of fig. 10 entered the same part but a short distance from the lophophore.



FIG. 9. FIG. 10. FIG. 11. FIG. 12.

FIGS. 9 and 10, nerve-mass of *FREDERICELLA REGINA* from the same zooid, viewed dorsally and laterally. FIG. 11, lateral view of nerve-mass from another zooid of the same colony. FIG. 12, dorsal view of nerve-mass of *PLUMATELLA DIFFUSA*. T', Epistomic nerve-trunk. T'', Brachial nerve-branch. T''', Polypidal nerve-branch. T'''' (Æsophagal nerve-branch. T, Gastric nerve-branch. T, Intestinal nerve-branch. U, The Brachial and Oral branches of the Lophophoric nerve-branch.

generally visible (figs. 9, 10, T'''). I was unable to follow these branches further than to their points of contact with the alimentary canal, the æsophagal branch to the æsophagus, which it probably encompasses forming a true æsophagal collar, the central, or Gastric branch, to the upper part of the stomach, and the dorsal, or Intestinal-branch, to the intestine. They undoubtedly supply the walls of these organs with nervous filaments, but these were too minute to be definable among the more highly colored cells of the alimentary canal.

The anterior set of nerve-branches are six in number, three on either side of the nerve-mass. Their bases sometimes coalesce in one main trunk on either side as in fig. 11, and they may then be very readily distinguished but frequently it is a matter of great difficulty to define even the æsophagal, which is the one most gen-

The form of the nerve-mass of any of the remaining genera, in a direct view, differs greatly from that of *Fredericella* (Figs. 9, 12), instead of being elliptical it is elongated, and has a depression on the posterior side dividing the lateral or ganglionic centres of distribution from each other. This change is in great measure due to the different position of the mass. For instead of being upright and parallel to the œsophagus as in *Fredericella* the posterior end is rotated outwards until the whole becomes horizontal as in *Pectinatella* (Pl. 11, fig. 1, S'). During this rotation the epistomic nerve-trunk passes from the anterior to the posterior end along the side corresponding to the ventral side of the nerve-mass in *Fredericella* (Pl. 11, fig. 1, and figs. 10, 11, T'). The lophoric and the polypidal nerve-branches separate from each other forming four distinct, independent nerve-trunks, two from each lateral ganglion. The former may occupy any position upon the posterior sides of the ganglions from the dorsal end, which correspond to their position in *Fredericella*, to the neighborhood of the epistomic trunk, while the latter have an equal range on the anterior side. With the exception of the epistomic nerve-trunk there is, at least in the zooids of *Pectinatella magnifica*, no regularity in the origin of the nerve-trunks within the limits above described, and, besides this, the character of the nerves themselves and the form of the nerve-mass may be greatly altered in different zooids of the same stock. Thus in Pl. 11, figs. 1, 2, S', the two dextral ganglions are given from two different zooids of the same colony which reverse each others outlines, the small ventral end of fig. 2, corresponding to the large ventral end of the ganglion in fig. 1, and the large dorsal end of the former to the small dorsal end of the latter.

The same figures also show the variability of the nerve-trunks. The epistomic nerve in one springs directly from the end of the ganglion, while in the other it rests on a raised pediment on the posterior side, and the lophophoric nerve-trunk in one comes from the posterior side of the ganglion and is made up of confluent nerves; in the oth-

er it is one single trunk on the dorsal end. There is, in fact hardly any difference between the nerve masses of *Plumatella* and *Pectinatella*, taking any two individuals at random, one from each genus, which may not be equaled by selecting two zooids from a single colony in any species. Although there are sometimes considerable differences between individuals of *Pectinatella magnifica* and those of *Plumatella*, I have yet to see a greater difference than may be found between different zooids of the same species.

The same contractions and hoistings of the mass are as frequent in all the remaining genera of the suborder as in *Fredericella*, the contraction invariably happening in the same manner and towards the posterior side, or side corresponding to the ventral side of the mass in *Fredericella* (Pl. 11, fig. 3). The nerves of the alimentary canal were not observed in any other genus than the last named, but it is probable, that in propitious lights they may be found somewhere on the anterior side between the lophophoric and epistomic nerve-trunks. The polypidal nerve-trunks of all the Hypocreptian genera are marked by the presence of one additional pair of nerve-branches, the Brachial-branches. These part from the polypidal nerves and striking out laterally enter the endocyst either on the side, or close to the bases of the arms and undoubtedly supply them with nervous filaments (Pl. 11, fig. 1, T'').

The conditions of the brachial branches of the lophophoric nerve, are considerably altered in *Plumatella*, and its allies, to correspond with the extension of the arms and the larger number of tentacles to which they distribute filaments. Their length therefore is much greater, but otherwise they do not appear to have changed (Pl. 13, fig. 13, U). Prof. Allman supposes that the oral and brachial branches from the opposite sides of the lophophore join each other on the median line, thus forming a nervous collar about the mouth. I have, however, entirely failed both in *Fredericella* (Pl. 9, fig. 1), and in *Cristatella* (Pl. 13, fig. 13), to substantiate this opinion. Dumortier and Van Beneden figure nerves in the so called Alcy-

onella fungosa,* which encircle the œsophagus, and seem to correspond in respect to location with the œsophageal nerve-branches of *Fredericella*.

Dumortier was the first to discover the nervous system and did his work more thoroughly than any succeeding investigator. He demonstrated the existence of two lateral ganglia in the nerve-mass of *Lophopus crystallinus*, and, although I have been unable to see these ganglia with the same distinctness with which they are represented in Dumortier's figures, I have been able to verify his observations in great measure by collateral evidence.

That there are two ganglia united by a commissure in all the *Hypocrepia* can hardly be doubtful. The equality in the number of the nerves on each side and their distribution, not irregularly from any portion of the mass, but from the two swollen lateral ends, show that these are two ganglionic centres. In *Fredericella*, however, the commissure appears to be wanting and further observations are necessary in order to prove that the nerve trunks are invariably derived from the sides of the mass. If this is the case, as it appears to be in *Fredericella regina*, we shall be obliged to regard the nerve-mass of this genus as composed of two large ganglia, united by a branchless commissure as large, if not larger, than the ganglia themselves. The size of the commissure, however, seems to be immaterial since I have frequently seen it in *Plumatella*, *Pectinatella* and *Cristatella* of the same thickness as the ganglia themselves (Pl. 12, fig. 1, S). It must also be remembered, in comparing the nerve-mass of *Plumatella* and *Fredericella*, that the depression shown in fig. 12, page 107, is on the side which corresponds to the ventral side of the mass in *Fredericella* and would be hidden from view in a dorsal view of the mass in the last named genus, even if it existed there.

Dumortier mentions a peculiarity of *Lophopus*, which indicates the existence of a colonial nervous system, such as

*DUMORTIER and VAN BENEDEN. Op. cit. Pl. 4, fig. 5.

†DUMORTIER. Recherche sur les Polypes Comp. de l'eau douce, Bull. de l'Acad. Bruxelles, 1835, 2, p. 422.

has been discovered by Fritz Müller in *Seriolaria*.* He remarked in fact the same phenomena in *Lophopus crystallinus*, which led Müller to begin his investigation; namely, that when the cœcnœcium was touched all the polypides were alarmed, whereas, when a single polypide was disturbed it alone retracted.

I have examined with care all parts of the evaginable endocyst in other genera in order to find this colonial system, but without success. The only nerve-branch which might connect the nerve-mass with a general stalk would be the polypidal nerve-branch. This, however, appears to spread itself out on reaching the evaginable endocyst into a multitude of filaments too minute to be successfully followed.

The tentacles are the only tactile organs, and, as previously described, are the only means possessed by the polypides of receiving impressions from without.

The polypides are not sensitive to light. At ordinary temperatures even the darkness-loving *Fredericella* may be exposed for a time to the direct rays of the sun without any visible result, although but just removed from the perpetual shade in which it had previously lived. The loudest noises prove equally ineffectual; in a word, they remain fully expanded and confidently at ease until the water is agitated.

The epistome has been thought to be an organ of taste, and certainly, besides its position, it has a pliability which would seem to confirm such an opinion. The border is capable of a tactile motion similar to that of the human tongue, and it takes cognizance of what passes into the mouth by frequent and repeated jerks towards the aperture. Although used in closing the mouth in order to retain the food, I have never yet seen it prevent the entrance of anything. This duty, as previously explained, falls to the lot of the surrounding tentacles.

DIGESTIVE SYSTEM.

The layers of the alimentary canal are the same in number and have very nearly the same character as those

*FRITZ MÜLLER. Das colonialnerven-system, *Archiv für. Naturg.* Bd.1, p. 311, 1860.

of the endocyst. There is (1) an inner, large celled membrane (Pl. 11, fig. 1, J') ; (2) one of smaller cells (Pl. 11, fig. 1, J'') ; (3) one of muscular fibre (Pl. 11, fig. 1, J''') ; and (4) an epithelial layer lined with muscular fibre (Pl. 11, fig. 1, J''').

(1) The cells of the first membrane, like those of the first membrane of the endocyst, are large and resemble hexagonal prisms with rounded ends. They have not, however, the power of contracting and expanding individually, as in the first membrane of the evaginable endocyst, and the thickness of the membrane is greatly increased only when the cells are forced out in folds by the contraction of the walls. In the œsophagus they are of a yellowish color, owing, probably, to the elaboration within them of buccal secretions. In the stomach, this membrane is permanently plicated, and the cells upon these plications probably, in the absence of any specialized hepatic organ, subserve the functions of a liver. They contain a brown fluid described by Allman as an hepatic secretion, which is liberated when needed by the rupture of the walls of the cells.

The membrane between these folds being of clear yellow color, the stomach appears externally, as if striped with alternate longitudinal bands, of yellow and brown. It is of a light brown color in the intestine of all the genera, with the exception of *Cristatella* where it has a bluish tint.

(2) The second layer is made up of small cells, and retains about the same dense character throughout its whole extent. A definite line of demarcation was found above the funiculus, and this layer probably, does not enter in the composition of that organ which appears to be composed solely of the third and fourth layers.

(3) In the third layer the fibres or muscular cells are arranged transversely. A lateral view in section shows them, like flattened cubes, resting upon the second membrane. These transverse cells or fibres, compress the walls, producing the peristaltic movements of the œsophagus, stomach and intestine.

[To be continued. The plates referred to were issued in vol. iv.]

VI. *Flora of the Hawaiian Islands.*

BY HORACE MANN.

[Communicated Nov. 5, 1866.]

SERIES I.
PHÆNOGAMOUS OR FLOWERING PLANTS.

Vegetables bearing proper flowers, that is, having stamens and pistils, and producing seeds, which contain an embryo.

CLASS I.
DICOTYLEDONOUS OR EXOGENOUS PLANTS.

Stems formed of bark, wood, and pith; the wood forming a layer between the other two, increasing, when the stem continues from year to year, by the annual addition of a new layer to the outside, next the bark. Leaves netted-veined. Embryo with a pair of opposite cotyledons, or rarely several in a whorl. Flowers having their parts usually in fives or fours.

DIVISION I.
POLYPETALOUS EXOGENOUS PLANTS.

Floral envelopes double, that is, consisting of both calyx and corolla; the petals not united with each other.*

ORDER I. RANUNCULACEÆ.

Herbs with a colorless acrid juice; the sepals, petals, stamens and pistils all free (hypogynous) and separate, the two latter usually indefinitely numerous; the seeds with a minute embryo at the base of fleshy albumen: abounding only in cool regions; represented in gardens by Larkspurs, Aconites, Anemone, &c., but on these islands only by the genus after which the order is named.

1. RANUNCULUS Linn. [Makou.]

Sepals 5. Petals 5, flat, with a little pit or scale at the base inside. Achenia numerous, in a head, mostly flattened, pointed; the seed erect.

* In many exceptional cases, some species or some genera belonging to polypetalous orders are destitute of petals.

—Annuals or perennials. Stem-leaves alternate. Flowers solitary or somewhat corymbed, yellow, rarely white.

A large genus, mostly from temperate and frigid regions.

1. *R. HAWAIIENSIS* Gray. (*Enum.* No. 1.*) Hairy; stem erect, 3° high,† branched; leaves biternately compound, their primary divisions on petioles 1'-3' long, the secondary narrowed at the base into short and usually margined petioles, or nearly sessile, cuneate or oblong, 2-3-cleft; the lobes oblong or ovate-lanceolate, incised, and toothed. Main petioles long, dilated and partly sheathing at the base. Leaves of the upper part of the stem and branches simply ternate or trisected, with the divisions laciniate-toothed or incised; the floral undivided and lanceolate. Peduncles 1'-2' long, somewhat fascicled or corymbed. Petals $\frac{1}{4}$ ' long, longer than the hairy calyx, obovate, and with a conspicuous 2-cleft appendage on the short claw. Achenia 2'' or more long, including the stout subulate beak, in a head of $\frac{1}{4}$ ' in thickness when fully grown.

Wooded regions of Hawaii.

2. *R. MAVIENSIS* Gray. (*Enum. No. 2.*) Nearly glabrous; stem slender, 3°-4° long, much branched, decumbent and spreading, or not strictly erect. Leaves trisected, membranaceous, minutely hairy, the lower on long petioles, their divisions ovate, short-petioled, 2'-3' long, sharply serrate and more or less incised and 2-3-lobed or trifid. Upper leaves less divided until the uppermost are small, lanceolate, and nearly entire. Peduncles terminal, dichotomal, hairy, 1' long or less, one-flowered. Flowers much as in No. 1, but smaller. Achenia smaller, and more abruptly contracted at the apex, in a head $\frac{1}{4}$ ' in diameter. A *Var.* has the leaves more divided, and is more hairy.

Mountains of West Maui and Hawaii. The *Var.* on the mountains of Kauai.

ORDER II. MENISPERMACEÆ.

Woody twiners, with alternate palmately veined leaves and no stipules; small diœcious flowers, their petals all free and separate, 6 petals before as many sepals, and usually the same number of stamens before these, also as many or half as many pistils. Ovule and seed solitary. Embryo large with little albumen. Bitter tonic plants, or sometimes (as in *Cocculus Indicus*) narcotic; chiefly of warm regions; here represented by a single genus and species.

*The "*Enum.*" refers to the authors Enumeration of Hawaiian plants in the Proceedings of the American Academy, Vol. 7, 1896.

†The degree sign (°) is here used to signify feet; that for minutes ('), inches; that for seconds ("), lines or twelfths of inches.

1. COCCULUS DC.

Sepals, petals and stamens 6, the latter two short. Anthers terminal, globular, 4-celled. Pistils 8-6 in the fertile flowers. Styles cylindrical, pointed. Drupe globular, the mark of the stigma near the base, the ovary in its growth after flowering being strongly incurved, so that the (wrinkled and grooved) laterally flattened stone takes the form of a crescent or ring. The slender embryo horse-shoe-shaped. Cotyledons narrowly linear and flat.—Flowers in axillary racemes or panicles. *Subgenus*, NEPHROICA Miers. Petals bifid, lobes acute.

Genus of several species, chiefly Indian, extending also into Africa and Australasia; two North American species.

1. C. (NEPHROICA) FERRANDIANUS Gaud. (*Enum. No. 3.*) Stem herbaceous, slender, twining, hairy, with a reflexed pubescence, at length nearly glabrous. Leaves rather coriaceous, ovate and subcordate, and obtuse or retuse, or ovate-lanceolate, acuminate and somewhat narrowed at the base, 3-5 nerved, 1'-3' long, entire, strigose pubescent when young, soon nearly glabrous. Petioles slender, hairy. Peduncles shorter than the petioles; the fertile few-flowered, the sterile few-many-flowered. Flowers greenish, the petals of the sterile ones auriculate-inflexed below around the filaments. Fruit blue, about 2' in diameter.

Kaala Mountains, Oahu; mountains behind Honolulu. Puna and Waimea, Hawaii. Mountains of Kauai.

ORDER III. PAPAVERACEÆ.

Herbs, with milky or orange juice (narcotic, as that of the Poppy, and sometimes acrid), with regular flowers, lasting but a day, mostly 2 sepals falling when the corolla (of twice as many petals) expands, numerous hypogynous stamens, and a compound ovary with two or more parietal placentæ; in fruit a many-seeded capsule. Embryo minute, in copious albumen. Represented in gardens by the Poppy (especially the *P. somniferum* or Opium Poppy), which has a radiate crown of many stigmas sessile on the ovary, its placentæ projecting to form imperfect partitions; and in waste places by the Mexican Poppy:—

1. ARGEMONE Linn. [Puakala.]

Stigmas 4-7, nearly sessile on the top of the ovary. Capsule obovate or oblong, opening at the top in short valves between the parietal placentæ. Leaves usually prickly.

A small American genus.

1. A. MEXICANA Linn. An erect hard glaucous and glabrous

annual, 2°-3° high, with spreading branches. Leaves alternate, clasping, sinuately pinnatifid, and bordered with prickly teeth, spotted with white along the primary veins. Flowers terminal, yellow or whitish, 1'-3' in diameter. Capsule about 1' long.

Introduced in the neighborhood of Honolulu rather abundantly, and in other parts. Of American origin, but now very abundant in all tropical countries.

ORDER IV. CRUCIFERÆ.

Herbs, sometimes shrubby plants, with a pungent watery juice, and regular flowers; known from all others by the 4 sepals and 4 petals along with hypogynous tetradynamous stamens (i. e. 6, two of which are shorter than the other four), the fruit (called a *siliqua*, or when short a *silicle*) a 2-celled capsule but with 2 parietal placentæ. But in two of the genera the silicle has only a single seed in each cell. Embryo variously folded: no albumen.—A large order in cool regions, well known by such representative as the Mustard (*Sinapis nigra* and *S. alba*), Water-Cress (*Nasturtium officinale*), Radish (*Raphanus sativus*); Cabbage and Turnip (*Brassica oleracea* and *B. Rapa*) &c.

Silique slender, several seeded, 1. CARDAMINE.
Silicle only 2-seeded,

Very flat, opening by 2 valves discharging the seed, 2. LEPIDIUM.

Two-lobed, splitting into 2 closed pieces, 3. SENEGBIERA.

1. CARDAMINE Linn. [Paihi.]

Pod linear, flattened, usually opening elastically from the base; the valves nerveless or veinless or nearly so; seeds in a single row in each cell, wingless; their stalks slender. Cotyledons with the radicle applied to their edges. Flowers white or purple.—Herbs.

A large genus, mostly in the temperate and colder regions both of the northern and southern hemispheres.

1. *C. HIRSUTA* Linn. (*Enum. No. 4.*) Mostly smooth, sometimes hairy; leaves pinnate with 3-15-leaflets, or lyrate-pinnatifid; leaflets of the lower leaves rounded, angled or toothed; of the upper, oblong or linear, often entire; petals twice as long as the calyx (white); the narrow pods and slender pedicles upright: style shorter than the width of the pod.

In woods, in districts of Waimea and Kona, Hawaii. (Probably introduced). An almost world wide plant.

2. LEPIDIUM Linn.

Pouch roundish, much flattened contrary to the narrow partition, and notched at the apex; the valves narrow, boat-shaped and keeled. Seeds one in each cell, pendulous. Seeds usually with the radicle

applied to the back of one of the cotyledons, but in both the Hawaiian species, with the radicle applied to their edges!—Flowers small, white. Stamens often only two!—The Hawaiian species are undershrubs but usually the species are herbs.

A considerable genus, of temperate and tropical regions.

1. *L. OWAHIENSE* Cham. & Schlecht. (*Enum. No. 5.*) Pods nearly orbicular, wingless, notched; the shallow notch including the short style. Leaves obovate, tapering at the base into a short margined petiole; entire in the lower half, the upper half coarsely serrated, or sometimes the leaves are narrower and nearly entire.

Coast of Oahu and Hawaii; also Kaala Mountains, Oahu. Lanai.

2. *L. SERRA* H. Mann. (*Enum. No. 6.*) Mature pods broadly orbicular, broader than long, scarcely notched, and terminated by the short and delicate style; the young pods somewhat ovate-rhomboidal in outline. Leaves lanceolate, tapering to a point at both ends, somewhat long petioled, their margins incised-serrate like a saw.—A straggling, much branched shrub, 2°–3° high.

In the Hanapepe Valley, Kauai.

3. *SENEBIERA* Poir.

Pouch flattened contrary to the narrow partition; the two cells indehiscent, but falling away at maturity from the partition as strongly wrinkled or tuberculate closed nutlets, 1-seeded. Cotyledons long and narrow, bent transversely below the middle, so that the radicle lies against the back of one of them. Style very short. Low and diffuse or prostrate annuals or biennials, with minute whitish flowers. Stamens often only two.

A small genus, of the warmer regions of the globe.

1. *S. DIDYMA* Pers. (*Enum. No. 7.*) Leaves 1–2-pinnately parted. Pods notched at the apex, rough-wrinkled.

Road-sides, &c., becoming common. (Doubtless introduced). Originally from the warm parts of America, but now diffused nearly all over the world.

ORDER V. CAPPARIDACEÆ.

Herbs or shrubs, with either a pungent juice like that of *Cruciferae* (as in *Capers*), or nauseous; like the former order in having 4 sepals, 4 petals, &c.; but the stamens when 6 not tetradynamous, often very numerous, the ovary 1-celled, commonly raised above the rest of the flower on a stalk (stipitate), and the seeds kidney-shaped, the embryo coiled instead of folded. Chiefly in warm climates.

Herbs: stamens 6: capsule with 2 placentæ,

Stamens on the long stalk of the ovary, 1. *GYNANDROPSIS*.

Stamens on the receptacle with the petals, 2. *CLEOME*.

Shrubs: berry with several placentæ, 3. *CAPPARIS*.

1. GYNANDROPSIS DC.

Sepals 4. Petals 4, clawed. Torus depressed hemispherical, the petals inserted around its base, the long gynophore springing from its centre. Stamens 6; the filaments monadelphous, adnate to the very long gynophore for half its length or more, then free and distinct, filiform, nearly equal: anthers oblong or linear, fixed near the base, introrse, the cells opening longitudinally. Ovary stipitate, 1-celled, with 2 parietal placenta: stigma nearly sessile, obtuse. Ovules numerous and usually in two series on each placenta, horizontal, amphitropous. Capsule pod-like, long-stalked 1-celled, 2-valved. Seeds many, round-reniform, exalbuminous. Embryo conformed to the seed; cotyledons short, incumbently incurved; radicle superior.—Viscid glandular herbs, with alternate and palmately 3-7-foliate leaves, and white or purplish flowers in a leafy raceme.

A small genus, in the tropics of both hemispheres.

1. *G. PENTAPHYLLA* DC. Annual, 1° or more high, covered with long and short, and mostly clammy hairs; lower and middle leaves 5-foliate, petioled, upper 3-foliate, much smaller, nearly sessile; leaflets obovate, nearly entire; pods linear, often curved, 2' or more long, glandularly rough, tipped with a short style and broad stigma. Seeds reniform, rough with little pustules.

Introduced and becoming naturalized around Honolulu. Common in most warm and tropical countries.

2. CLEOME Linn.

Sepals 4, persistent or deciduous. Petals 4, sessile or clawed, deciduous. Stamens 6, on a short, subglobose torus, free and distinct; filaments equal, filiform, longer than the petals; anthers 2-celled, opening introrsely and longitudinally. Capsule (often) stipitate, like that of *Gynandropsis*, as are the seeds, &c.—Herbs, rarely suffruticose, with alternate palmately 3-7-foliate, or rarely simple, leaves, without stipules. The yellow, purple or white flowers in terminal leafy racemes; the upper bracts simple.

A considerable genus, in tropical and warm regions, especially in America, Egypt and Arabia.

1. *C. SANDWICENSIS* Gray. (*Enum. No. 8.*) Herbaceous, viscid pubescent; stem, petioles and midrib of the leaflets sparsely aculeate with small and weak prickles: the stipular ones stronger. Stem leaves of 5 oblong-lanceolate leaflets, 1'-2½' inches long, and cinereous on both sides with a short and close viscid pubescence. Floral leaves ovate, slightly cordate, on short petioles, shorter than the very pubescent and somewhat setose hispid viscous pedicels. Calyx hairy and viscous like the pedicels. Petals white or yellowish, 3" long, oblong-ovate, on short

claws. Pod $1\frac{1}{2}$ –2' long, 2" in diameter, smooth and glabrous, terete, tipped with a thick subsessile stigma, and raised on a filiform glabrous stipe of nearly its own length.

Coast of Oahu. Nihaa.

3. CAPPARIS Linn. [Pilo.]

Sepals 4, imbricate in æstivation. Petals 4, imbricate. Stamens very numerous (rarely definite or few) on a small hemispherical torus. Ovary stipitate, 1-celled, with numerous ovules on 2 parietal placentæ. Berry globose or elongated, coriaceous, many-seeded; seeds lying in pulp.—Trees or shrubs, often climbing, and frequently armed with spines. Leaves alternate, simple, entire or nearly so, with spiny or setaceous stipules. Flowers solitary or racemose, paniced or corymbose, generally white or cream-colored.

A considerable genus, chiefly tropical, but a few species in the warmer temperate regions of Europe and Asia.

1. *C. SANDWICHIANA* DC. (*Enum. No. 9.*) A spreading shrub, 3°–4° high; unarmed. Leaves elliptical, entire, somewhat long petioled, with a very minute hairiness on the under side. Pedicels slightly longer than the leaves, 1-flowered. One sepal very much larger than the others and saccate, an inch or more long; petals unequal; stamens very numerous, 2' long, longer than the white petals. Fruit on a much curved stalk, 2' or 3' long $\frac{1}{2}$ ' or more in diameter, with its numerous seeds in an orange-colored pulp.

Coasts of the islands, in barren places, on lava and coral rock. Also on the Society Islands.

ORDER VI. VIOLACEÆ.

Herbs or shrubs, with alternate stipulate leaves, and more or less irregular perfect flowers, the sepals, petals and stamens 5 and hypogynous, and a 1-celled ovary with 3 parietal placentæ, surmounted by a style which is bent to one side at the apex; the fruit a capsule; embryo straight and nearly as long as the fleshy albumen. Represented by the principal genus, Violet, and by another which is peculiar to these islands.

Flowers irregular: the lower petal extended at the base into a spur

or sac: filaments broad and short, 1. *VIOLA*.

Flowers almost regular, no spur: filaments slender, 2. *ISODENDRON*.

1. *VIOLA* Linn.

Sepals nearly equal, produced beyond their insertion at the base. Petals spreading, the lower often much the largest and saccate at the base. Stamens with proper filaments very short or obsolete; the connective dilated, membranaceous, and produced above the anther into

a wing-like or triangular or ovate apical appendage; the two anterior produced from the back into spur-shaped appendages, which are received into the spur or sac of the anterior petals. Ovary with two or more series of ovules on each placenta. Style clavate or subulate; stigma often one-sided.—Herbs or shrubs. Leaves alternate; stipules foliaceous, often persistent. Peduncles or scapes axillary, 2-bracteolate, 1-4-flowered. Many produce apetalous or cryptopetalous and fertile radical flowers during the summer.

A large genus, mostly of temperate and cold regions of the northern hemisphere, a few in Africa, Australasia and Polynesia.

Perennial marsh herbs.

Flowers on axillar one flowered peduncles; stems creeping, . . . 1. *V. Kavaensis*.

Flowers 2-4, umbellated at the summit of the upright terminal

scape; stems ascending, 2. *V. Maviensis*.

Under-shrub, 3. *V. Chamissoniana*.

1. *V. KAVAIENSIS* Gray. (*Enum. No. 10.*) Stems or stolons creeping, flexuose, rather slender, glabrous, with rather large, ovate or ovate-lanceolate, scaly and brownish stipules, the upper ones narrower and more acuminate; all with bristle-shaped and glandular tipped teeth. Leaves mostly crowded at the extremity of the flower bearing stolons, rounded, slightly cordate, or somewhat reniform; but with the base more or less cuneate-decurrent into the slender petiole, coriaceous, thickly punctate, closely serrate with obtuse and inflexed-appressed teeth, strongly nervose, usually glabrous. Peduncles about 2' long, 2-bracted a little below the flower. Sepals oblong lanceolate, glabrous. Petals pale blue, hardly as long as the calyx, the lower but little the largest and inconspicuously saccate at the base. Stamens scarcely shorter than the petals; filaments slender, connective hardly at all produced. Style short, thick, unclinate-cucullate.—It is possible that the only flowers which have ever been observed, of this species, are not the normal, but cryptopetalous ones. In this case the normal ones are a desideratum, and the character is to be altered in accordance.

On the leeward part of the mountains of Kaul.

2. *V. MAVIENSIS* H. Mann. (*Enum. No. 11.*) The ascending caudices a foot long, thickly clothed at the summit with densely imbricated ovate-lanceolate stipules, which are beset with bristle-shaped teeth. Leaves rounded and clustered at the apex of the caudex, serrate, tapering at the base into slender petioles. Scape 3'-8' long, 2-bracted about the middle. Pedicels about 4, umbellate from the bracted summit of the scape, 2-bracted. Petals dark blue, the lower one very widely and shortly saccate, all twice as long as the lanceolate sepals. Differing from No. 1 in its erect growth, and upright scape bearing an umbel of flowers at its apex!

Summit of mountain of West Maui.

3. V. CHAMISSONIANA *Gingins*. (*Enum. No. 12.*) Upright shrub, 1° - 6° high, stem $\frac{1}{2}$ ' - $\frac{1}{4}$ ' and more thick, branching, glabrous. Leaves ovate or oblong-ovate or ovate-lanceolate, and somewhat cordate or rarely acute at the base, acuminate, serrulate, on petioles $\frac{1}{2}$ ' - 2' long. Stipules scale-like, brown and small, entire or serrate in the manner of the foregoing species. Peduncles axillary, $\frac{1}{2}$ ' - 1' long, 1-2-bracted above the middle. Flowers 6'' - 8'' long. Sepals linear-lanceolate, very little produced at the base. Petals light blue or violet, oblong-spatulate, beardless, nearly equal, the lower one broadly saccate at the base. Anthers glabrous, tipped with a slender subulate appendage, the lower two bearing a short and thick appendage on the back. Style curved, thickened and gibbous at the apex. Stigma one-sided, truncate.

On the Kaala Mountains, Oahu, and in the vicinity of Waialua. Mountains above Waimea, Kauai.

2. ISODENDRION Gray.

Sepals equal. Corolla of 5 equal linear-spatulate petals, which are connivent in a tube, and with their tips spreading. Stamens with slender filaments, without appendages, the connective not prolonged; anthers affixed by the base. Ovary with two ovules on each placenta. Style elongated, subclavate, apex incurved, simple; stigma lateral. Ovules collateral, horizontal. Capsule coriaceous, surrounded by the persistent sepals and petals, 3-seeded, 3-valved. Seeds obovate. — Shrubs. Leaves alternate, clustered; stipules triangular subulate, appressed, persistent. Flowers axillary, short-pedicelled, small.

Genus peculiar to the Hawaiian Islands.

1. I. PYRIFOLIUM *Gray*. (*Enum. No. 13.*) Shrub about 6° high, branching; branches slender, glabrous except the younger which are a little pubescent, beset with the persistent stipules which remain long after the leaves have fallen. Leaves clustered, membranaceous, ovate-elliptical or oval, obtuse at both ends, $1\frac{1}{4}$ ' - 2' long, loosely pinnately veined, crenate or minutely serrate with small glandular-tipped teeth, glabrous, or minutely pubescent below when young, as are the petioles (3'' - 5'' long). Stipules triangular, acute or acuminate, oblique, scarious, keeled with a strong and thick midrib which is minutely silky, pubescent externally, cillolate on the margins, $1\frac{1}{4}$ '' long. Flowers solitary. Pedicels recurved, 2'' - 3'' long, 2-bracted in the middle. Sepals equal and nearly distinct, ovate and acute, in texture and form like the stipules. Corolla hypogynous, or obscurely perigynous; petals 4'' long. Stamens inserted with the petals, and much shorter and alternate, distinct and glabrous. Anthers oblong.

Wooded parts of Kaala Mountains, Oahu.

2. *I. LONGIFOLIUM* Gray. (*Enum. No. 14.*) Shrub 6° high, more or less, and glabrous throughout, with few stout branches, roughened with the scars of the fallen leaves, and above with the persistent stipules. Leaves clustered, coriaceous, 6'-8' long, $1\frac{1}{4}'$ -2 $\frac{1}{4}'$ wide, obovate-lanceolate, acuminate or rarely obtuse, acute at the base, reticulated-veiny, the midrib prominent beneath; the margins obscurely repand-undulate or serrulate. Petioles $\frac{1}{2}'$ -1 $\frac{1}{2}'$ long. Stipules, sepals, petals and stamens much as in No. 1. Filaments subulate-linear, flattened, about the length of the anthers.

With the preceding species.

3. *I. LAURIFOLIUM* Gray. (*Enum. No. 15.*) Branches rather stout, entirely glabrous, as is the whole plant. Leaves coriaceous, oblong-lanceolate, somewhat narrowed at both ends, obtuse at the base, 3' long, 1' wide, sparingly and obscurely repand-serrulate, or entire, very short petioled, shining above, pale beneath. Petioles only 1''-2'' long, seldom longer than the stipules. Pedicels a line long, 2-bracted. Flowers mostly like those of the preceding species; except that the sepals are lanceolate and much narrower.

With the preceding species.

ORDER VII. BIXACEÆ.

The type is the Arnotto, *Bixa Orellana*, a tree cultivated for the red coloring matter of the pulp which surrounds the seeds. Our only wild plant of the order is of a genus which is distinguished from all related orders having a one-celled ovary with 2 or 3 parietal placentæ,—especially from the last and the next,—by being diœcious and apetalous.

1. XYLOSMA Forst.

Sepals 4 or 5, scale-like, often cilliate, imbricate. Petals none. Stamens indefinite; anthers versatile, short. Ovary raised on an annular disk. Placentæ 2, or rarely 3-6, parietal, 2- few-ovuled. Style entire or more or less divided, crowned by the obtuse stigmas, or sometimes the stigma subsessile, broad and lobed. Berry indehiscent, small, 2-14-seeded. Seeds obovoid, somewhat angular by mutual pressure, smooth, crustaceous; embryo straight, cotyledons flat. — Trees, often spiny. Leaves toothed or entire. Flowers clustered in the axils, or rarely shortly racemose.

Genus of several species, scattered through tropical and subtropical regions.

1. *X. HAWAIIENSE* Seemann. (*Enum. No. 16.*) Shrub 5°-10° high, unarmed, glabrous. Leaves coriaceous, ovate or ovate-oblong, obtuse

or slightly acuminate, minutely glandulose dentate, 2'-4' long, petioled. Racemes axillary, about 6-flowered, bracted, pedicels 6"-8" long, 2-bracted below the middle. Sepals 4, rounded or oblong, obtuse or barely pointed, glabrous, with the margin ciliated. Hypogynous disk glandular. Stamens many, about 4 times as long as the sepals. Berry about the size of a pea, glabrous; stigma nearly sessile and 4-lobed.

Nuuanu Valley, Oahu, and probably in other places.

ORDER VIII. PITTOSPORACEÆ.

Trees or shrubs, with alternate and entire coriaceous leaves, differing from the shrubby Violaceæ in having no stipules, perfectly regular flowers, and a minute embryo in hard albumen: represented by the chiefly Polynesian genus.

1. PITTOSPORUM Banks. [Aawa.]

Sepals 5. Petals 5, their claws erect and usually cohering into a tube. Filaments subulate; anthers erect. Ovary sessile or shortly stipitate on a more or less developed torus, imperfectly or nearly perfectly 2- (rarely 3-5-) celled. Capsule ovate or obovate, often flattened. Valves coriaceous or woody, bearing the placenta on their middle. Seeds smooth or reticulated, usually covered with a resin. — Shrubs or trees, usually evergreen. Leaves in some species much clustered at the ends of the branches. Flowers in a terminal corymb, or few or solitary, or often clustered in the axils.

A considerable genus, chiefly Australian and Polynesian, with a few tropical and sub-tropical African and Asiatic species.

Flowers in a terminal umbel: calyx large and very woolly, 1. *P. confertiflorum*.
Flowers fascicled in the axils, or below the leaves on the naked
branches: peduncles almost none.

Calyx and ovary more or less tomentose or pubescent.

Leaves thick coriaceous: style thrice shorter than the ovary,
with a two-lobed stigma, 2. *P. cauliflorum*.

Leaves thick-coriaceous: style as long as the ovary, with a
terminal simple stigma, 3. *P. terminaloides*.

Leaves thin-coriaceous: style as long as the ovary, with a
capitate stigma, 4. *P. spathulatum*.

Calyx and ovary (as is the whole plant) glabrous, 5. *P. glabrum*.

Flowers on long peduncles and pedicels, 6. *P. acuminatum*.

1. *P. CONFERTIFLORUM* Gray. (*Enum. No. 17.*) Tree 20° high. Branches stout, leafy, woolly when young. Leaves coriaceous, crowded, obovate or obovate-oblong, obtuse or short acuminate, 3'-7' long, 1'-2½' wide, the young ones woolly on both sides, the older ones very glabrous and shining above, densely tomentose beneath; margins revolute. Petiole margined, 1' or less long. Flowers numerous and

crowded in a dense terminal and nearly sessile umbel, large for the genus, 6"-8" long. Pedicels $\frac{1}{4}$ ' long, and, as the calyx, very woolly, the sepals distinct, orbicular-ovate, obtuse, imbricated, one-half shorter than the petals. Corolla light yellow, petals thickish, their broadly ovate summits forming a spreading limb; imbricated or sometimes convolute in aestivation. Stamens nearly as long as the tube of the corolla; anthers oblong. Pistil 6" long. Ovary sessile, tomentose, about the length of the style, incompletely 2-celled. The stigma terminal, truncate. Capsule globular-ovoid, somewhat flattened, tomentose, becoming glabrate, two-valved, many-seeded; the valves thick and woody, wrinkled and rough, about an inch long. Seeds closely packed and angled, minutely tuberculate-rugose. A *Var.* has the leaves with a more rusty wool beneath; the lobes of the calyx narrower.

East and West Maui, 4,000'-6,000'. Summit of Lanai.

2. *P. CAULIFLORUM* *H. Mann.* (*Enum. No. 18.*) Tree 20°-30° high, a foot in diameter, loosely branched. Leaves thick-coriaceous, obovate or elongated-obovate, very obtuse, tapering to a narrow base and borne on margined petioles 1' or more long, above very glabrous and shining; beneath, as well as the young petioles, somewhat woolly, clustered at the ends of the long, otherwise naked branches. Flowers in fascicles, borne on the naked stem often far below the leaves, on short few-flowered peduncles. Calyx broadly ovate, $1\frac{1}{4}$ " long, slightly woolly. Petals loosely cohering in a tube about 4" long, the limb spreading, 2"-3" long. Stamens about half the length of the corolla tube; anthers sagittate. Ovary tomentose, 4" long, three times as long as the style which bears a 2-lobed stigma. Capsule an inch in diameter, clothed at first with a fine deciduous tomentum, flattened. Endocarp orange-yellow. Seeds numerous, slightly roughened.

Kaala Mountains, Oahu.

3. *P. TERMINALIOIDES* *Planchon.* (*Enum. No. 19.*) Shrub 6°-8° high. Leaves thick-coriaceous, somewhat crowded at the ends of the branches, oblong-ovate, obtuse, tapering at the base into a very short petiole, glabrous and shining above, clothed beneath with a woolly pubescence, $2\frac{1}{4}$ ' long, 6"-10" wide; their margins strongly revolute. Peduncles very short, usually on the branches below the leaves, few-flowered, woolly. Calyx pubescent, sepals wholly distinct, thick, oval, about 1" long. Petals 5" or 6" long. Stamens less than half as long as the corolla tube; anthers sagittate. Ovary tomentose, about the length of the style, which is terminated by a simple stigma. Capsule minutely tomentose or nearly smooth, much compressed, two-valved; the valves nearly woody, 9" in diameter. Seeds numerous, rugose-roughened.

Hawaii, in the neighborhood of Kilauea, and on Mauna Loa and Hualalai at 7,000' elevation.

P. SPATHULATUM *H. Mann.* (*Enum. No. 20.*) A small tree 15° - 20° high. Leaves rather thin-coriaceous, spatulate or cuneate-oblong, rounded at the apex, or sometimes slightly pointed, quite glabrous, 3' - 4' long, 1' - 1½' wide, tapering into a short petiole. Peduncles axillary or below the leaves, short, tomentose, 3 - 7-flowered. Sepals very broadly ovate, obtuse, 1" or less long, slightly tomentulose. Petals 4" or 5" long. Stamens less than half the length of the petals; anthers sagittate. Ovary tomentose and about the length of the style; stigma capitate. Capsule glabrate and nearly smooth. Seeds smooth.

Kaala Mountains (and perhaps other parts) of Oahu.

5. P. GLABRUM *Hook. & Arn.* (*Enum. No. 21.*) A small tree, glabrous throughout. Leaves thin-coriaceous, 2' - 5' long, 1' - 1½' wide, ovate-oblong or oblanceolate, tapering at the base into a short petiole, the apex obtuse, rounded, or more or less acuminate. Peduncles terminal, or lateral and below the leaves, spreading or pendulous, glabrous, half an inch or more long, racemosely or corymbosely few- (5-9-) flowered; pedicels 3" long. Sepals ovate, acute, 1½" long, glabrous. Corolla 6" long, white or cream-colored as in all the Hawaiian species, cohering into a tube, the spreading tips 2" long. Stamens nearly as long as the corolla tube; anthers oblong. Style twice the length of the glabrous ovary; stigma truncate. Capsule subglobose, somewhat compressed, glabrous, smooth or roughened, two-valved, the valves coriaceous, an inch or less in diameter. Seeds numerous, closely packed, 2" - 3" in diameter, smooth.

Mountains in the vicinity of Honolulu, Oahu.

G. P. ACUMINATUM *H. Mann.* (*Enum. No. 22.*) A small tree 15° - 20° high. Leaves thin, chartaceous, oblanceolate, acuminate, entirely glabrous, tapering into a petiole 3" - 6" long. Peduncles axillary, 1' - 2' long, slender, corymbosely 5-8-flowered. Pedicels 3" - 4" long. Sepals and bracts narrowly subulate, 2" - 3" long. Petals 4" - 5" long. Stamens less than half the length of the petals; anthers sagittate. Style slender, longer than the tomentose ovary; stigma capitate. Capsule tomentose, much tuberculate-roughened.

Mountains above Waimea, Kauai.

ORDER IX. CARYOPHYLLACEÆ.

Herbs or shrubs, with opposite entire leaves, symmetrical 4-5-merous flowers, with or without petals; the distinct stamens no more than twice the number of the sepals, either hypogynous or perigynous; styles 2-5; seeds attached to the base or the central column of the 1-celled (rarely 3-5-celled) pod, with a slender embryo coiled or

curved around the outside of mealy albumen. — Stems usually swollen at the joints; uppermost leaves rarely alternate. Leaves often united at the base. Calyx imbricated or valvate, persistent. Seeds amphitropous or campylotropous. — Represented in gardens by Pinks (*Dianthus*), etc.

Petals present.

Calyx campanulate or tubulose; ovary and stamens raised on a stipe (gynophore), 1. *SILENE*.

Calyx not campanulate nor tubulose; gynophore none, 2. *CERASTIUM*.

Petals none.

Staminodia five and opposite the sepals, 3. *SCHIEDREA*.

Staminodia none. Sepals four with a much smaller fifth one, 4. *ALSINIDENDRON*.

1. *SILENE* Linn.

Calyx campanulate tubulose, 5-toothed, 10-nerved, rarely many-nerved. Petals 5, with a narrow claw, and an entire or bifid blade, often bearing 2 scales at the base. Stamens 10. Gynophore more or less elongated. Ovary 1-celled or spuriously septate at the base. Styles 3. Capsule dehiscent by 6, or rarely 3, teeth or valves at the apex. Seeds affixed by the margin; embryo periphical. — Annual or perennial herbs, or sometimes woody, erect and caespitose or diffusely spreading. Flowers solitary or cymose, often forming one-sided spikes, or terminal panicles. Seeds tuberculate.

A very large genus, abundantly scattered over the whole world, excepting, mostly, the tropics.

1. *S. STRUTHIOLOIDES* Gray. (*Enum. No. 23.*) Stems about 1° high, woody, much branched, erect or spreading. Leaves crowded, two ranked, subulate, pungently acute, grooved, with incurved margins, at length spreading, $\frac{1}{4}$ –1' long, glabrous. Flowers racemiform-paniculate, at first spreading, erect in fruit. Peduncle 3'' long, two-bracted, 1–2-flowered. Calyx $\frac{1}{4}$ ' long, tubular, greenish, tinged with purple; teeth ovate, 1'' long. Blade of the petals cuneate and two-lobed, exserted about 3 lines, greenish white, turning purplish; the dilated claw bearing at its summit a small fleshy two-parted appendage. Stamens included. Stipe 3'' long. Ovary 3-celled at base. Capsule partly exserted, 6-valved, many-seeded. Seeds minutely reticulate-roughened. A *Var.* has the leaves more spreading, and a little pubescent with fine viscous hairs (as are the branches and inflorescence), their margins especially pubescent-ciliate.

Mountains of Hawaii, nearly to the limit of vegetation. Region around Kilanea.

2. *S. LANCEOLATA* Gray. (*Enum. No. 24.*) Stems 1°–2° high, branching, woody, but slender; branches naked below, leafy above, glabrous. Leaves narrowly lanceolate, acuminate, nerved, sessile, nar-

rowed towards the base, where they are ciliate, otherwise glabrous, coriaceous, flat, spreading, $1\frac{1}{2}$ '-2 $\frac{1}{2}$ ' long, 3'' wide; floral ones reduced to subulate bracts. Flowers numerous, in a naked and pedunculate corymb-like cyme. Pedicels 2''-3'' long. Calyx 4'' long, glabrous, tubular campanulate, in fruit becoming ovoid, five-toothed. Petals white, nearly twice the length of the calyx, the cuneate blade nearly entire. Stipe very short. Capsule ovoid, not exserted. Seeds rather strongly muricate.

Mountains of Kaula. Maui.

2. CERASTIUM Linn.

Sepals 5, rarely 4. Petals as many, 2-lobed or cleft, rarely entire. Stamens twice as many, or fewer. Styles equal in number to the sepals, and opposite them. Pod 1-celled, usually elongated, membranaceous, opening at the apex by twice as many teeth as there are styles, many-seeded. Seeds rough. Flowers white, in terminal cymes.

A large genus, spread nearly all over the globe.

1. *C. VISCOSUM* Linn. Stems clammy-hairy, spreading (6'-15' long); leaves oblong, quite green; upper bracts scarious-margined; flowers at first clustered; pedicels longer than the obtuse sepals, the earlier ones in fruit much longer.

Becoming introduced on Maui. Common in the North Temperate zone.

3. SCHIEDEA Ch. & Schl.

Calyx five-parted; persistent. Corolla none. The petal-like staminodia 5, hyaline, opposite the sepals. Fertile stamens 10, inserted on the base of the calyx, the five opposite the sepals adhering to the bases of the staminodia, and longer than the five alternate ones. Styles filiform, 3 or rarely 4-5-7. Ovary 1-celled; the numerous ovules affixed to the central columella. Capsule opening by as many valves as there are styles. Seeds many, estrophiolate. Embryo annular, surrounding the farinaceous albumen.—Under shrubs or perennial herbs. Leaves opposite, without stipules. Cymes contracted-thyrsoïd to diffusely-paniculate, or rarely a few-flowered cyme.

Genus peculiar to the Hawaiian Islands.

EUSCHIEDEA. Filaments capillary. Styles 3, or rarely 4-5, stigmatose on the inner face.—Flowers small, in a close thyrusus, or diffusely paniculate.

Panicle very loose: sepals acuminate: leaves 1-nerved.

Staminodia bifid at the apex: filaments exserted.

Capsule longer than the calyx: seeds few, tuberculate-roughened, 1. *S. Nuttallii*.

Capsule not exceeding the calyx: seeds numerous, smooth, 2. *S. diffusa*.

Staminodia lanceolate, acuminate: filaments shorter than the calyx.

Leaves broad and clasping at the base, 3. *S. amplexicaulis*.

Leaves narrow and tapering at the base, 4. *S. stellarioides*.

Panicle somewhat contracted: leaves 3-5-nerved.

Leaves narrow-lanceolate, acuminate, 3-nerved, 5. *S. Menziesii*.

Leaves broad-lanceolate, 3-5-nerved, 6. *S. Hookeri*.

Panicles thyrsoid, much contracted, interrupted: leaves 1-nerved.

Staminodia bifid at the apex: filaments exerted.

Leaves lanceolate, 7. *S. Nystrina*.

Leaves filiform, 8. *S. spargutina*.

Staminodia bifid at the apex: filaments shorter than the calyx, 9. *S. Remyi*.

Thyrus globose, sometimes three near together: leaves 3-5-

nerved: *staminodia* entire and obtuse: filaments very

short, 10. *S. globosa*.

NOTHOSCHIDEEA. Filaments complanate-subulate. Styles 7, stig-

matose all round. *Staminodia* entire, obtuse, very

short: filaments shorter than the calyx.—Flowers very

large for the genus, and few; sepals subpetaloid, 11. *S. viscosa*.

1. *S. NUTTALII* Hook. (*Enum. No. 25.*) Smooth throughout. Suffrutescent, branched, 2°-3° high. Leaves coriaceous, 2'-3' long, 12"-18" wide, or the lower larger, oblong or ovate-lanceolate, obtuse and abruptly pointed, on short petioles; midrib prominent. Panicle compound, deliquescent, ample, often 1° long, diffusely spreading. Pedicels 3"-6" long. Calyx 1½" long; sepals ovate-lanceolate, acuminate. Capsule ovoid-oblong, longer than the calyx, few-seeded. Seeds tuberculate roughened.

Near Honolulu, Oahu. West Maui.

2. *S. DIFFUSA* Gray. (*Enum. No. 26.*) Stems slender, several feet long, spreading and reclining, loosely branched. Leaves oblong-lanceolate, acuminate, 3'-4' long, thin, nearly or quite glabrous. Panicle compound, very loose, 6'-20' long; branches, peduncles, and pedicels capillary, minutely pubescent, the latter 1'-2' long in fruit. Calyx 2", or in fruit 3" long, sepals ovate or ovate-lanceolate, acuminate, 3-5-nerved at the base, scarious margined. Capsule not exceeding the calyx, 3-5-valved. Seeds very numerous, quite smooth.

Hawaii, in forests. West Maui.

3. *S. AMPLEXICAULIS* H. Mann. (*Enum. No. 27.*) Suffrutescent. Leaves oblong-linear from a wide, auriculate, and clasping base, 1-nerved, obtuse, mucronate, about 2' long and 5"-6" wide. Panicle compound, diffusely spreading, bracted, about 1° long, its younger parts and the calyx minutely hirsute. Pedicels capillary, 4"-8" long. Calyx 2" long, sepals ovate-lanceolate, acuminate, with scarious and fibrillose margins. Capsule few-seeded, nearly equalling the calyx in length, 3-valved. Seeds smooth.

"Kauai or Nihoa."

4. *S. STELLARIOIDES* H. Mann. (*Enum. No. 28.*) Bushy and very

much branched from a suffruticose base; finely hirsute in the axils of the leaves, and on the inflorescence. Leaves numerous, small, spatulate-linear, entire at the obtuse apex and mucronate, or slightly notched, 1-nerved, tapering at the hirsute-ciliate base into a very short petiole. Panicle compound, diffusely branched, bracted. Calyx 2" long; sepals lanceolate, acuminate, rather thick, narrowly scarious-margined, longer than the 3-valved capsule. Seeds few, tuberculate-roughened.

On the mountains above Waimea, Kaula; abundant at "Halemanu."

5. *S. MENZIESII* Hook. (*Enum. No. 29.*) Leaves sessile, narrowly lanceolate, long acuminate, three-nerved. Panicle contracted, branched, erect. Calyx and pedicels pubescent-tomentose.—Very imperfectly known.

6. *S. HOOKERI* Gray. (*Enum. No. 30.*) Glabrous throughout. Woody and stramineous at the base, terminating in a panicle and bearing several opposite upright branches, also terminating in panicles. Branches herbaceous, obscurely 4-sided, the leaves gradually diminishing upwards among the branches on the panicle, and at length becoming connate, subulate, and bract-like. Leaves $1\frac{1}{2}'$ or more long, $2\frac{1}{2}''$ – $3''$ wide, rather thin, lanceolate or broad-lanceolate, 3–5 nerved, nerves parallel, distinct. Panicle as long or longer than the leafy branch, bracted toward the base, contracted, $1\frac{1}{2}'$ wide; primary branches slender and flexuose. Pedicels very slender, 2 or 3 times longer than the calyx, spreading or recurved. Capsule $1''$ – $1\frac{1}{2}''$ long, longer than the ovate-lanceolate, rather obtuse sepals.

7. *S. LIGUSTRINA* Cham. & Schlecht. (*Enum. No. 31.*) Glabrous throughout. Shrubby, upright and dichotomously much branched, 2° – 3° high; at the base often $\frac{1}{2}'$ in diameter. Leaves connate at the base, $1'$ – $2'$ long, oblanceolate or oblong-lanceolate to narrowly lanceolate $1\frac{1}{2}''$ – $3''$ wide, broadest above the middle, gradually narrowed to the base, but sessile, shortly and abruptly mucronate, 1-nerved, margins thickish or slightly revolute. The thyrsus, or contracted panicle interrupted, $2'$ – $4'$ long, $\frac{1}{2}'$ – $\frac{3}{4}'$ wide, and terminating the branches, composed of 4 or 5 or more pairs of subsessile many-flowered cymes. Bracts very small, ovate or subulate. Pedicels $1\frac{1}{2}''$ – $6''$ long, thickened at the apex. Flowers $1\frac{1}{2}''$ – $2''$ long, the sepals of the 5- (or occasionally 4-6-) parted calyx, ovate or oblong, obtuse, fleshy, with scarious margins, obsoletely 3-nerved. Filaments elongated and exserted. Capsule ovoid, a little longer than the calyx, 3-4-valved. Seeds several, with a crustaceous and acutely tuberculate or muricate testa.

Kaula Mountains, Oahu.

8. *S. SPERGULINA* Gray. (*Enum. No. 32.*) Shrubby at the base, about 2° high, erect, much branched and very leafy, glabrous. Leaves spreading, approximate, and usually with smaller ones fascicled in their axils, filiform, 2' long and only $\frac{1}{4}$ " wide, 1-nerved, channelled above, mucronulate. Inflorescence much like that of *S. ligustrina*. Bracts of the lower part of the thyrsus like the leaves; of the upper, short, and ovate-subulate. Peduncles and pedicels minutely pubescent, 1"-2" long. Calyx about 1" long; the sepals ovate, obtuse, rather fleshy, nearly nerveless, very slightly pubescent near the base. Capsule ovoid, 3-valved, a little longer than the calyx. Seeds several, the testa obscurely tuberculate or roughened, nearly smooth.

Kanai. Lanai.

9. *S. REMYI* H. Mann. (*Enum. No. 33.*) Barely shrubby at the base. The lower leaves very narrowly linear, 2'-3' long, 1" wide, with smaller ones often fascicled in their axils, the upper ones subulate, all thin and flat, 1-nerved. Thyrsus much contracted and crowded, minutely pubescent. Sepals a line or less in length, ovate, obtuse, many-nerved. Styles 4-5, rather long. Capsule ovoid, shorter than the calyx. Seeds numerous, very nearly smooth.

Molokai.

10. *S. GLOBOSA* H. Mann. (*Enum. No. 34.*) Low and herbaceous, pruinose-puberulent on the upper part of the stem and on the inflorescence, otherwise glabrous. The simple branches rising from the base, a span to a foot high, bearing 4-5 pairs of leaves. The lower leaves obovate-lanceolate from a narrowed sessile base, somewhat fleshy, about 4' long and 1' wide, 3-5-nerved, the upper diminished into small subulate bract-like 3-nerved leaves but 10" long and 1"-2" wide. The upright stem bearing a compact globose thyrsus (rarely with two lateral ones) of an inch in diameter, composed of numerous many-flowered short cymules. Sepals ovate, obtuse, nerved below the middle, $1\frac{1}{4}$ " long, shorter than the 4-valved ovate-lanceolate capsule. Staminodia very short, blunt, entire, of about the length of the stamens. Seeds few, larger than in the other preceding species, and tuberculate roughened.

In the region of Koko Point, Oahu.

11. *S. VISCOSA* H. Mann. (*Enum. No. 35.*) Suffruticose, decumbent and spreading, with branches 2°-3° long, sending up somewhat erect flowering stems 8'-11' high. Whole plant covered with a glandular pubescence, especially viscous on the peduncles and pedicels. Leaves $1\frac{1}{4}$ '- $1\frac{1}{2}$ ' long, 4"-5" wide, evenly tapering at each end to a sharp point, borne on a margined petiole 2" long, and becoming glabrate on the upper surface with age, nerved with three well-marked

veins running from the base to the apex. The peduncled cymes terminal, composed of 2-6 flowers, on pedicels 6" long, arising from the axils of small (6" long and 1½" wide) floral leaves. The pubescent calyx 5"-6" long, of five petal-like ovate-acuminate many-nerved sepals, which enclose and surpass in length the ovate-lanceolate 7-valved capsule. Staminodia broadly-ovate, obtuse, small, a line long, and nearly as wide at the base. Styles 7, short at first, and stigmatose all round, but becoming longer with age. Seeds very numerous, roughened with short points.

On the mountains above Waimea, Kaula, at "Halemanu."

4. ALSINIDENDRON H. Mann.

Calyx four parted, the oval thickish and whitish sepals decussatingly imbricated, erect and connivent, rarely with a minute internal fifth one. Petals and staminodia none. Stamens 10, inserted upon the margin of a thin disk which is adherent to the calyx at its base: filaments filiform: anthers linear oblong, notched at both ends. Ovary one-celled, the many ovules affixed to a central columella: styles 4-7, short filiform, stigmatose on the inner surface near the apex. Capsule cartilaginous, 4-7-valved, many-seeded. Seeds estrophiolate.

Genus peculiar to the Hawaiian Islands.

1. A. TRINERVE H. Mann. (*Enum. No. 36.*) A glabrous branching shrub, about six feet high. Leaves 3'-4' long, 1½'-2' wide, of a somewhat chartaceous texture, oval or ovate, cuspidate-acuminate, tapering abruptly at the base into a margined petiole about an inch long, and with three strong ribs running from the base to the very apex. Cymes from the axils of the upper leaves, on peduncles an inch or more long. Flowers pendulous from the ends of long (3"-8") capillary pedicels, somewhat globose in shape, a little truncated at the base, and of a light or whitish color, about 4" long. Sepals fleshy at the base, but with thinner margins and apex, closely imbricated, the two outer completely enclosing the two inner in the bud, persistent and enclosing the fruit. Stamens shorter than the calyx, the filaments about as long as the erect anthers, which are affixed by a deeply notched base. Seeds roughened by longitudinal lines of blunt tubercles.

Kaala Mountains, Oahu, at an elevation of about 2,000 feet.

ORDER X. PORTULACACEÆ.

Herbs, with succulent leaves, and regular but unsymmetrical flowers; namely, sepals usually fewer than the petals; the stamens oppo-

site the petals when of the same number, but often indefinite; the petals sometimes none: otherwise nearly as in *Caryophyllaceæ*.

1. SESUVIUM Linn.

Calyx 5-parted, purplish inside, persistent, free. Petals none. Stamens 5-60, inserted on the calyx. Styles 3-5, separate. Pod 3-5-celled, many-seeded, opening transversely (*circumscissile*), the upper part falling off as a lid. — Prostrate maritime herbs, with succulent stems and (opposite) leaves, and axillary or terminal flowers.

A small genus, several species maritime.

1. *SESUVIUM PORTULACASTRUM* Linn. (*Enum. No. 37.*) Leaves lanceolate-oblong, flattish; flowers sessile or short peduncled; stamens many.

Coast of the Islands. On the coast of nearly all warm parts of the world.

2. PORTULACA Tourn. [*Akulikuli.*]

Calyx 2-cleft; the tube cohering with the ovary below. Petals 5, rarely 6, and the 7-20 stamens inserted on the calyx, fugacious. Style mostly 3-8-parted. Pod 1-celled, globular, many-seeded, opening transversely, the upper part (often with the upper part of the calyx) separating like a lid (*circumscissile*). — Annuals (or perennials?), with fleshy leaves, and often showy, white, purple, or red corollas.

Genus small, mostly tropical, and most of the species American.

Leaves with tufts of silky hairs in their axils.

Flowers solitary or nearly so, at the summit of the branches, . . . 1. *P. villosa*.

Flowers several together at the summit of the branches, . . . 2. *P. sclerocarpa*.

Leaves without silky hairs. Whole plant glabrous, . . . 3. *P. oleracea*.

1. *P. VILLOSA* Cham. (*Enum. No. 38.*) Low, diffuse; root fleshy. Leaves lanceolate or linear, obtuse, with tufts of silky hairs in their axils. Flowers sessile at the summit of the branches in a dense tuft of hairs; petals "purple," 5"-6" long, rather longer than the sepals. Seeds smooth, or when considerably magnified, minutely marked with sinuous areolations.

Dry plains in vicinity of Honolulu, Oahu.

2. *P. SCLEROCARPA* Gray. (*Enum. No. 39.*) Root fleshy and tuberous, hardy ligneous. Stems thickened at base, 2'-5' high, much branched. Leaves terete, subulate, 4" long, crowded, longer than the copious hairs. Flowers sessile and crowded at the summit of the branches, $\frac{1}{2}$ ' or more long, white (but always?). Capsule spherical, $1\frac{1}{2}$ "-2" in diameter, the thick walls of a firm and coriaceous texture,

adherent to the calyx-tube only at the base, a little above which it is tardily dehiscent. Placentæ 8. Seeds smooth, shining, or minutely areolate under a powerful lens.

Waimea, Hawaii. Sandy isthmus of Maui. Lanai, on the dry southern part especially.

P. OLERACEA Linn. Prostrate, very smooth; leaves obovate or wedge form; flowers sessile (opening only in sunny mornings); sepals keeled; petals pale yellow; stamens 7-12; style deeply 5-6-parted; flower-bud flat and acute.

Introduced and becoming common in cultivated and waste grounds.

ORDER XI. GUTTIFERÆ.

Tropical trees or shrubs, with a yellow resinous juice and opposite and entire coriaceous feather-veined leaves; the regular flowers hypogynous, with the sepals and petals much alike and both imbricated in æstivation, the many stamens more or less united at the base with each other, and with the base of the petals. Fruit a capsule opening by valves, or a drupe or berry.—To this order belongs the tree which yields Gamboge, and another allied tree produces the Mangosteen.

1. *CALOPHYLLUM* Linn. [*Kamanu*.]

Flowers hermaphrodite or polygamous. Sepals 2-4. Petals 4, rarely 2, 6, or 8. Stamens numerous, free or united into several bundles at the base. Ovary 1-celled, with a single erect ovule. Style filiform. Stigma peltate. Fruit a drupe.—Trees. Leaves elegantly striate, with numerous parallel transverse veins. Flowers in terminal or axillary short racemes, sometimes branching into panicles.

A tropical genus of several species, mostly Asiatic; a few in America.

1. *C. INOPHYLLUM* Linn. (*Enum. No. 40*.) A large and beautiful tree, glabrous throughout. Leaves broadly oblong-obovate or oblong, often acute at the base, and rounded or even retuse at the apex, 6' more or less long, petioled. Racemes axillary, loosely many-flowered, shorter than the leaves. Flowers rather long peduncled, subglobose in the bud, $\frac{3}{4}$ ' in diameter when open, white sepals 4, the inner ones petaloid. Petals 4 (or rarely 6-8), longer than the calyx. Fruit globose, an inch or more in diameter.

The only trees known to be growing on the Islands at the time of the first white settlers, are said to be those of a fine grove on Molokai, which were afterwards mostly (and most ruthlessly) cut down for ship-building, and a few other scattered ones. Native in many of the Pacific Islands, and in the East Indies.

ORDER XII. TERNSTROMIACEÆ.

Mostly tropical trees or shrubs with alternate undivided leaves, without stipules; the regular flowers hypogynous, with the usually 5 sepals and dissimilar petals imbricated in æstivation, the latter often united in a ring at the base. Stamens of the number of the petals and alternate with them, or more usually numerous, and often somewhat united with each other and with the base of the petals. Fruit a pod opening by valves, or berry-like. — The well-known Tea Plant and the Camellia belong to this Order.

1. EURYA Thunb.

Flowers unisexual or hermaphrodite. Sepals 5, imbricated. Petals 5, imbricated, united at the base. Stamens about 15, joined at the base: anthers adnate. Ovary 3- (rarely 2-5-) celled, with several ovules in each cell. Styles as many as cells, almost free or united nearly to the top. Fruit a dryish berry. Embryo much curved, in a somewhat granular albumen. — Trees or shrubs, with serrate leaves. Flowers axillary and small, sessile or on short pedicels. Bractlets persistent.

A small genus, mostly from the warmer parts of Asia and the Indian Archipelago, China and Japan.

1. *E. SANDWICKENSIS* Gray. (*Enum. No. 41.*) A large and much branched shrub. Leaves elliptical or oblong, coriaceous, 1' - 2½' long, ½' - 1' wide, mostly obtuse at the apex, slightly cordate at the base, closely serrate, reticulate-veined, very short petioled. Flowers solitary in the axils, on bractless nodding pedicels, 3" - 4" long, hermaphrodite (or sometimes polygamous?). Calyx brown, with 2 small bractlets at its base; sepals 5, the exterior smaller. Corolla pale yellow, longer than the calyx; petals obovate, thickish. Stamens 10-15, very slightly, if at all, adnate to the corolla; anthers mucronulate, longer than the filaments. Ovary 3-celled. Styles separate or variously united; stigma subcapitate.

Not uncommon on the mountains.

ORDER XIII. MALVACEÆ.

Herbs, shrubs, or trees; the alternate palmately veined leaves with stipules. Flowers regular, often with bractlets under the calyx. The calyx mostly of five sepals, more or less united at the base, valvate in æstivation; the petals of the same number, convolute in æstivation, and hypogynous. Stamens indefinite, monadelphous, united with the

claws of the petals; with one celled anthers and hispid pollen. Ovary several-celled with the placentæ in the axis; or ovaries several. Fruit capsular, or the carpels separate or separable; the seeds with a little mucilaginous or fleshy albumen, and a large embryo with variously incurved or folded foliaceous cotyledons. — To this Order belongs Cotton, the Okra (*Hibiscus (Abelmoschus) esculentus*) of the East Indies, and other useful and ornamental plants.

Carpels 1-ovulate, arranged in a ring round the axis.

Style-branches as many as carpels.

Ovule ascending, 1. MALVASTRUM.

Ovule pendulous, 2. SIDA.

Carpels with 2 or more ovules, more or less united in a several-celled capsule.

Style-branches or stigmas spreading. Seeds reniform.

Anthers terminating the staminal column. Carpels free at the top. Bractlets none, 3. ABUTILON.

Staminal column ending in five teeth below which the anthers are placed. Carpels united at the top. Bractlets several, 4. HIBISCUS.

Style club-shaped at the apex, undivided, or barely divided into short erect branches. Seeds obovoid or angled.

Bractlets 3-5, small, 5. THESPIESIA.

Bractlets 3, large and cordate, 6. GOSSYPIUM.

1. MALVASTRUM Gray.

Bractlets under the calyx 1-3, small, or sometimes wanting. Calyx 5-lobed. Staminal column divided at the top into several filaments. Carpels 5 or more, in a ring round the axis, 1-ovulate, indehiscent. Style with as many branches as carpels; stigmas terminal. Seed ascending. — Herbs. Flowers rather small, orange, red, or yellow.

An American genus of which one species is dispersed as a weed over most of the tropical regions of the Old World.

1. *M. TRICUSPIDATUM* Gray. (*Enum. No. 55.*) An erect branching herb, 2° - 3° high, hard and almost woody at the base, although sometimes annual, the branches sprinkled or covered with closely appressed hairs. Leaves on rather long petioles, from broadly ovate to lanceolate, 1' - 2' long, irregularly toothed and hairy. Flowers almost sessile in the axils of the leaves, or clustered towards the ends of the branches. Calyx campanulate, broadly 5-lobed, with 3 small narrow external bracts. Carpels 8-12, or even more, closely packed in a depressed ring, each one reniform, with 3 minute unequal points on the upper inner edge.

In waste places, often abundant. Probably of American origin, but now widely diffused as a weed over the warmer regions of the globe.

2. *SIDA* Linn. [Tlima.]

Calyx without bractlets, 5-lobed. Staminal column divided at the top into several filaments. Carpels 5 or more, in a ring round the axis, 1-ovulate, indehiscent or opening when ripe in 2 short valves at the top. Style with as many branches as carpels; stigmas terminal. Seeds pendulous. — Herbs or shrubs, more or less tomentose or softly hairy, rarely glabrous. Flowers usually yellow, on 1-flowered pedicels, or single or clustered in the axils of the leaves, or in terminal racemes.

A large genus, widely dispersed over the warmer regions of the globe.

Leaves green, slightly pubescent and scurfy with stellate hairs. Carpels bearing pubescent awns of about their own length, . . . 1. *S. Meyeniana*.

Leaves more or less canescent or softly tomentose. Carpels either blunt or with short awns.

Leaves round or ovate, and with the branches softly tomentose.

Carpels mostly blunt, 2. *S. fallax*.

Leaves round or ovate, whitish underneath. Carpels with short

awns, 3. *S. Bertum*.

Leaves oblong or lanceolate, whitish underneath. Carpels with

slender glabrous awns, 4. *S. rhombifolia*.

1. *S. MEYENIANA* Walp. (*Enum. No. 58.*) A slender, loosely branched shrub, 2°–3° high, nearly glabrous, the younger branches, petioles, and leaves scurfy with a stellate pubescence. Stipules setaceous, minutely hairy. Leaves membranaceous, green, ovate, oblong-ovate or rotund-ovate, acute or rarely obtuse, rounded or slightly subcordate at the base, sharply serrate, $\frac{1}{2}$ '–2' long. Peduncles axillary, usually solitary, often shorter than the leaves, slender. Calyx glabrous, the lobes triangular-ovate, sharply acuminate, about half the length of the oblique and yellow petals, 3" or more long. Carpels 5–9, nearly glabrous, 2-beaked; the beaks subulate-awned, pubescent, as long as the cell or longer.

Ridges above Honolulu, Oahu.

2. *S. FALLAX* Walp. (*Enum. No. 51.*) A low branching under-shrub, sometimes erect, at others, decumbent and spreading, 2°–3° high or long. Branches, with petioles and leaves, tomentose with a fine and close velvety pubescence. Leaves ovate, roundish-ovate, or oblong-ovate, rounded and usually cordate at base, very obtuse and round at the apex, or acute or acuminate, closely crenate-toothed with obtuse teeth, $\frac{1}{2}$ '–2' long, on petioles a third or half the length of the blade, strongly pinnate-veined. Stipules setaceous. Peduncles axillary, solitary or two or three from the same axil, filiform, equalling, or the upper exceeding, the leaves in length, articulated just below the flower. Calyx tomentose, the lobes ovate-triangular, acute or acuminate, or sometimes obtuse. Petals yellow, $\frac{1}{2}$ ' long, a third longer than

the calyx. Ovary minutely pubescent. Fruit subglobose, nearly glabrous; the carpels 6-12, $1\frac{1}{4}$ " long, slightly wrinkled, obtuse or very short awned.

In dry land on Oahu. Sandy isthmus of Maui (where the decumbent form is very abundant). Hawaii; Waimea, Kaula, and doubtless in other parts; rather common. Also from several of the Pacific Islands, Hongkong, and coast of China.

3. *S. SERTUM* Nutt. (*Enum. No. 52.*) Low and barely shrubby, much branched. Branches, with petioles, peduncles, calyx, &c., barely canescent with a minute pubescence. Leaves oval or subovate-oblong, obtuse and rounded at both ends, finely crenulate, canescent beneath with a minute and close pubescence, nearly glabrous above. Petioles two-thirds the length of the blade. Stipules setaceous. Peduncles axillary and usually solitary, capillary, 1'-2' long. Lobes of the calyx ovate, very obtuse. Petals yellow, nearly twice the length of the calyx, 5"-6" long. Carpels about 8 in number, nearly glabrous, abruptly tipped with two subulate-aristiform beaks, which are shorter than the cell, and minutely hairy.

Mountains behind Honolulu, Oahu.

4. *S. RHOMBIFOLIA* Linn. (*Enum. No. 54.*) A perennial herb or undershrub, very variable in size, 1°-3° high; when erect, with oblong-lanceolate leaves 3' long, green above, and slightly hoary beneath; sometimes much branched, and very spreading, with oblong or almost ovate leaves an inch or two long, and very white beneath. Peduncles much longer than the short petioles, jointed about the middle. Flowers rather small, yellow. Lobes of the calyx broadly ovate, acute, glabrous, 2"-3" long. Carpels about 10, with slender glabrous awns about 1", or rarely awnless.

In waste places. An introduced weed, now common throughout the tropics.

3. *ABUTILON* Gærtn.

Calyx without outer bracts, 5-lobed. Staminal column divided at the top into several filaments. Carpels 5 or more, in a ring round the axis, each with several ovules, and, when ripe, united at the base, but diverging at the top, and opening in 2 valves. Style with as many branches as carpels. Stigmas terminal. — Herbs or shrubs, with the habit of *Sida*, from which they only differ in their carpels, and the number of ovules and seeds.

A considerable genus, spread over the tropical and subtropical regions of both Worlds, but more especially in America.

1. *A. INCANUM* Don. (*Enum. No. 49.*) Woody at the base, about 1° high, covered with a very fine and close velvety or canescent pubescence. Stipules very small, filliform, deciduous. Leaves cordate ovate,

acuminate or acute, or sometimes rounded, finely serrate, the lower ones 1' - 1½' long, on petioles one half their length; the upper ones smaller. Peduncles mostly axillary and solitary, mostly longer than the leaves, articulated near the apex. Flower 3" long. Calyx canescent, 5-cleft to the middle, half as long as the yellow corolla, much shorter than the capsule, spreading in fruit. Capsule cinereous-tomentose, short-oblong, 5-carpellary, strongly 5-lobed, truncate at the apex; the carpels barely mucronulate at their obtuse tips, dehiscent at the apex and down the dorsal suture, 8-seeded. Seeds globular, pubescent, superposed.

Coast of Oahu, near Honolulu and Diamond Hill.

2. *A. MENZIESII* Seemann. (*Enum. No. 50.*) A small shrub about 2° (?) high, canescently tomentose. Leaves cordate, acuminate, coarsely serrate, above green and with a stellate pubescence, below canescently tomentose, 2' - 3' long, on petioles longer than the blade. Stipules minute. Peduncles axillary, solitary, shorter than the petioles. Sepals partly joined, broadly ovate, acute. Corolla about 1' long "purplish." Carpels 5, ovate-oblong, acuminate, hirsute; with persistent placentæ. Seeds 8 in each cell, hirsute.

4. HIBISCUS Linn.

Bractlets round the calyx several, either free or more or less united into a lobed or toothed involucre. Calyx 5-lobed or 5-toothed. Staminal column bearing several short filaments below the summit. Carpels 5, with several ovules in each, united into a single 5-celled ovary. Style 5-lobed at the top, or nearly entire, with terminal stigmas. Capsule opening loculicidally in 5 valves. — Herbs, shrubs, or trees. Flowers often large and showy. A considerable genus, widely spread over the warmer regions of the globe.

§ 1. *HIBISCUS* proper. Bractlets almost entirely free from one another and from the calyx.

Leaves ovate-cordate, slightly lobed, 1. *H. Youngianus*.
Leaves ovate-cordate, deeply lobed, 2. *H. Brackenridgii*.
Leaves small, ovate, acute, entire, 3. *H. Arnottianus*.

§ 2. *PARITIUM*. Bractlets (10-12) united into a more or less deeply saucer-shaped involucre, surrounding the base of the calyx.

Leaves ovate-cordate, acuminate, entire, 4. *H. tiliaceus*.

1. *H. YOUNGIANUS* Gaud. (*Enum. No. 46.*) Erect and shrubby. The branches, petioles, involucre, calyx, and fruit are densely covered with short setæ, among the bases of which, as also upon the leaves, is a velvety canescence; the setæ are at length in good part deciduous, leaving a persistent papillose base. Leaves ovate, cordate, 4-5-lobed, angles obtuse, irregularly dentate, acute, or acuminate, below veluti-

nous, above scabrous, on petioles 1' - 2' long. Peduncles solitary, axillary, scarcely as long as the petioles. Leaves of the involucre 10, terete, two-lobed at the apex. Sepals joined to the middle, strongly 10-nerved, triangular-lanceolate, in fruit closed over the capsule. Corolla yellow, 2' - 3' long, turning rose-colored in fading. Capsule 1' long, rather less bristly than the calyx. Seeds very smooth.

Marshes near Honolulu, Oahu. Hanapepe Valley, Kauai.

2. *H. BRACKENRIDGII* (Gray). (*Enum. No. 47.*) Shrubby, 3° - 4° high. Flowering branches rather stout, glabrous, or when young scurfy puberulent with the stellular pubescence of this family, very leafy. Leaves on long petioles (3' - 4' long) membranaceous, nearly glabrous, rounded in outline and subcordate, 5 - 7-ribbed, 5 - 7-cleft to the middle or deeper, the lobes separated by acute and very narrow sinuses, somewhat ovate in form, acute or obtuse, coarsely toothed or incised, 2' - 4' in diameter. Stipules setaceous, caducous. Flowers solitary in the axils near the summit of the branches, where they are much crowded. Peduncles or pedicels $\frac{1}{2}$ ' long, pubescent and sparingly hispid. Leaves of the involucre 9, setaceous-subulate, rigid, nearly glabrous, spreading, entire, adnate to the base of the calyx, 8'' - 10'' long. Calyx very hispid with fulvous hairs, 5-cleft to below the middle; the short tube 10-ribbed; the lobes lanceolate, acute. Corolla yellow, pubescent externally, 2' - 3' long. Style 5-lobed only at the apex; stigmas depressed-capitate. Ovary densely villous-hispid, with 4 - 6 biseriate ovules to each cell. Capsule ovoid, $\frac{1}{2}$ ' long. Seeds angled, minutely tomentose at the hilum, the surface scurfy with star-shaped scales.

West Maui. Lanai.

3. *H. ARNOTTIANUS* Gray. (*Enum. No. 48.*) A small tree 10° - 30° high when full-grown, with a fine globular head, and in flower exceedingly showy: glabrous throughout. Leaves ovate or oval, rounded or slightly contracted at the base, 3-nerved (or obscurely 5-nerved), somewhat coriaceous, entire, obtuse or acute, 2' - 4' long; petioles 1' - 1 $\frac{1}{2}$ ' long. Stipules subulate, caducous. Flowers solitary, terminating the branches or in the uppermost axils, on peduncles 6'' - 20'' long. Leaves of the involucre lanceolate or subulate, entire, only 2'' - 3'' long. Calyx cylindrical or tubular, $\frac{1}{2}$ ' - 1' long, membranaceous, rather deeply five-toothed, puberulent within, glabrous externally, inclining to split down on one side with age. Corolla white, the petals oblong or narrowly obovate, 2' - 3' long, narrowed at base, and united into a slender tube, about 1' long, which is exerted beyond the calyx. Staminal column red, very long (5' - 6'), slender, erect, and copiously antheriferous on long and slender bright red filaments. Style 5-cleft

at the apex, the divisions 4" long; stigmas capitate. Ovary oblong (½' long), glabrous. Seeds numerous, biserial in each cell, glabrous.

Mountains behind Honolulu, Oahu. Vicinity of Hilo, Hawaii. *Native names*, "Puahanui" and "Akiakala."

4. H. (PARITIUM) TILIACEUS Linn. (*Enum. No. 45.*) A small tree. Leaves on long stalks, orbicular-cordate, shortly acuminate, entire or crenulate, white or hoary underneath with a short close tomentum, nearly glabrous above, 3'–5' in diameter. Peduncles short, in the upper axils or at the ends of the branches. Flowers large, yellow, with a dark crimson centre. Involucre campanulate, divided usually to the middle in 10–12 lobes, about half the length of the calyx. Calyx nearly an inch long, the lobes lanceolate. Capsule about 1' in diameter, opening in 5 valves, bearing the placentas on their centre and their thin margins turned inwards so as to make the capsule appear 10-celled.

Very common below 1,000° or 2,000° elevation, especially in moist places. A common sea-coast tree in many tropical countries, and very abundant in the Pacific Islands. *Native name*, "Han."

Hibiscus Rosa-sinensis Linn., is much cultivated for its showy scarlet or purplish flowers. A shrub. Leaves ovate, long acuminate, coarsely toothed, glabrous. Petioles, peduncles, bractlets, and calyx puberulent. The 10 bractlets linear acute. Calyx lobes broadly ovate, acuminate.

5. THESPESIA Corr.

Bractlets 3–5, small or deciduous. Calyx truncate, minutely dentate, rarely 5-toothed. Staminal column dentate below the apex, and branching into an indefinite number of filaments. Ovary 5-celled; cells few ovuled. Style somewhat club-shaped at the apex, 5-grooved, or partly divided into short, erect, club-shaped, and stigmatic branches. Capsule very hard-coriaceous, loculicidally 5-valved or nearly indehiscent. Seeds obovoid, glabrous, or tomentose; cotyledons much complicated, nearly including the short suberect radicle, often black dotted. — Trees or upright herbs. Leaves entire or lobed. Flowers usually yellow, showy. Calyx not especially dotted, but the cotyledons very much so in *T. populnea* and *T. Lampada*.

A small genus, of the Pacific Islands, tropical Asia, and Madagascar.

1. *T. POPULNEA* Corr. Tree with something the aspect of the *Hau*, but more erect. Leaves round-cordate, acuminate, entire, 4'–5' in diameter. Flower yellow, petals 2' long. Capsule globose, nearly indehiscent. Seeds 4" long, villous at the base and angles.

Lahaina, and probably elsewhere. In all probability introduced. Common on many of the Pacific Islands, and the coasts of tropical Asia and Australia.

6. *GOSSYPIMUM* Linn. [Mau.]

Bracts 3, large, cordate. Calyx truncate or 5-lobed. Staminal column naked below the apex or rarely branching into many anther-bearing filaments. Ovary 5-celled; cells many-ovuled. Style club-shaped at the apex, 5-grooved, and with 5 stigmatic surfaces. Capsule loculicidally dehiscent. Seeds subglobose or angled, densely pubescent or glabrous, and with a long wool (cotton). Albumen thin or none. Cotyledons strongly folded and enclosing the radicle in an auricle as their base.—Large herbs, or shrubs, sometimes tree-like. Leaves 3–9-lobed or rarely entire. Flowers large, white, yellow, or purple. Bracts usually black-dotted, laciniate-toothed, or entire. Cotyledons usually black-dotted.

A small genus, the species of which are very imperfectly distinguished as a general thing; found in most tropical countries.

Leaves glabrous, or nearly so.

Bracts large, deeply lacinate, 1. *G. religiosum*.

Bracts large, nearly entire or crenate toothed, 2. *G. Drynarioides*.

Leaves canescent-tomentose, 3. *G. tomentosum*.

1. *G. RELIGIOSUM* Linn. (*Enum. No. 43.*) Shrub. Upper leaves 3-lobed, lower ones 5-lobed, the lobes ovate, acute; leaves 2'–3' in diameter, on petioles of about their length or shorter, faintly black-dotted. Peduncles about 1' long. Bracts large, ovate, cordate, divided at the apex in 10–12 lacinae which are as long as the entire part, linear-lanceolate, and fine-pointed. Lobes of the calyx ovate, subulate, acuminate, and, like the bracts, black-dotted. Capsule 1' long, roughened by sunken dots. Seeds free from one another, glabrous and with a fine white cotton.

Probably introduced.

2. *G. DRYNARIOIDES* Seem. (*Enum. No. 44.*) A glabrous shrub. Leaves 5–7-lobed, 3' long; lobes triangular, acute, green above, paler and black-dotted beneath. Peduncles 4'–5' long, 1-flowered. Bracts large, coriaceous, cordate-ovate, obtuse, sinuate-crenate, 10–12-nerved, 1½'–2' long, 1'–1½' broad. Calyx 5-lobed. Petals obovate-oblong, pubescent externally, 4'–5' long.

Hawaiian Islands. (Nelson, in Herb. Brit. Museum.)

3. *G. TOMENTOSUM* Nutt. (*Enum. No. 42.*) Shrubby, 2°–6° high, much branched. Young branches, leaves, and bracts canescent-tomentose. Leaves thickish, 2'–4' in diameter, on petioles 1'–2' long, 3–5-lobed; lobes ovate-acuminate or acute, entire, more or less black-dotted. Stipules cordate or ovate, acuminate. Peduncles one-, rarely two-flowered. Bracts ovate-oblong, cordate at the base, lacinate at the apex, the divisions ovate-lanceolate and entire, more or

less black-dotted. Calyx somewhat truncated, much dotted. Petals yellow, obovate, pubescent on the uncovered part outside, $1\frac{1}{2}'$ long. Capsule three-valved, the valves pointed. Seeds with a fine ochraceous tomentum, and a wool (cotton) of the same color $\frac{3}{4}'$ long.

Rather common in dry parts near the coast. Also, in the Viti Islands.

ORDER XIV. STERCULIACEÆ.

Nearly allied to the last Order, from which it is distinguished by its usually definite and nearly free stamens, and the two-celled anthers with smooth pollen. — Chocolate is made of the seeds of *Theobroma Cacao*, a South American tree of this Order.

1. WALTHERIA Linn.

Calyx 5-lobed. Petals oblong-spatulate, flat. Stamens 5, opposite the petals, shortly united at the base. Anthers terminal, with 2 parallel cells. Ovary sessile, of a single carpel, with 2 erect ovules. Style eccentric; the stigma usually fringed. Capsule usually opening on the back in 2 valves. Seed usually solitary, with albumen. — Herbs, undershrubs, or trees, with a stellate tomentum often mixed with soft hairs or pubescence. Leaves toothed. Stipules narrow. Flowers clustered.

A considerable genus in tropical America, with one species spread all over the warmer regions of the globe.

1. *W. AMERICANA* Linn. (*Enum.* No. 56.) An undershrub, 1° – 2° or more high, densely tomentose or softly villous in every part. Leaves short-petioled, oval-oblong, $1'$ – $1\frac{1}{2}'$ long, obtuse, toothed, soft and plicately veined. Flowers small, yellow, in dense heads, almost sessile in the axils of the leaves, or the upper ones clustered on a short spike. Bracts narrow. Calyx $1\frac{1}{2}''$ long. Petals nearly twice as long, narrow-oblong. *W. Indica*, Linn.

In open and sterile or sandy soil, common. A common weed within the tropics in both the New and Old World.

2. *W. PYROLÆFOLIA* Gray. (*Enum.* No. 57.) A branched undershrub, about 3° high; branches and petioles canescently villous-tomentose. Leaves coriaceous, roundish, usually somewhat retuse at both base and apex, $8''$ – $15''$ in diameter, finely toothed, glabrous (or slightly puberulent when young) above, below canescent with a fine and close pubescence, becoming glabrate with age. Petioles $3''$ – $6''$ long. Stipules setaceous, deciduous. Flowers crowded in subsessile axillary heads, or rarely on a short peduncle. Bracts lanceolate, silky villous, like the calyx, which is of equal length, $8''$ long, and 5-cleft scarcely to

the middle, the lobes obtuse. Petals glabrous, narrow-spatulate, connected only at the base, one-third longer than the calyx. Ovary very villous. Style filiform; stigma simple and truncate.

Sandy isthmus of Maui.

2. *GUAZUMA* Plum.

Sepals 5, more or less united at the base. Petals 5, concave below, linear-ligulate and deeply bifid at the apex. Stamens slightly connected at the base: sterile ones 5, lanceolate: fertile ones united into 5 trifid filaments, each opposite to a petal, and bearing 3 anthers. Styles 5, connivent. Stigmas simple. Fruit indehiscent, woody, externally muricated with club-shaped variously-connected tubercles. 5-celled, many-seeded. Seeds ovate-roundish. Albumen very thin, fleshy. Cotyledons plaited.—Shrubs or trees with stellate pubescence. Leaves entire. Peduncles axillary and terminal, somewhat dichotomously branched, many-flowered.

A small tropical American and Javan genus.

1. *G. TOMENTOSA* HBK. (*Enum. No. 57^a.*) Leaves ovate-oblong, acuminate, cordate and unequal at the base, toothed; upper side stellately-puberulous, under side with a stellate white tomentum.

Near Honolulu. Probably introduced.

ORDER XV. TILIACEÆ.

Trees or shrubs: the alternate leaves with deciduous stipules. Calyx with valvate æstivation, deciduous. Petals imbricated in æstivation. Stamens several or indefinite, with two-celled anthers. Styles united into one; the fruit two to five-celled, or, by obliteration, one-celled when ripe. In other respects nearly as in *Malvaceæ*.

1. *ELÆOCARPUS* Linn. [Kali.]

Sepals 4 or 5. Petals as many, toothed, lobed, or fringed. Stamens several, inserted on a glandular disk. Anthers with adnate cells, opening at the top in transverse valves, often ciliate at the edge. Ovary 3–5-celled, with 2–4 ovules in each cell. Style subulate. Fruit a drupe; the nut usually 3–5-celled. Seeds solitary in each cell, pendulous.—Trees. Leaves entire or serrate. Flowers in axillary or lateral racemes.

A considerable genus, of tropical Asia, Australasia, and the Pacific Islands.

1. *E. BIFIDUS* Hook. and Arn. (*Enum. No. 58.*) A tree 20°–30° high, twigs gummy at their ends. Leaves ovate-acuminate, subcoriaceous, glabrous on both sides, remotely serrate with blunt teeth, 2'–4'

long, 1' - 2' wide, on rather dark-brown petioles. Peduncles axillary, longer than the petioles, 5 - 6-flowered. Calyx of 5, ovate-lanceolate somewhat acute, sepals, which are pubescent within, about 3" long. Petals 3" long, oblong-ovate, pubescent outside, with revolute margins, bifid at the apex, but otherwise entire and obtuse. Torus discoid, glandular. Stamens 14-16: filaments short, pubescent: anthers linear-oblong, emarginate. Ovary ovate, 2-celled and tapering into the simple two-grooved style: stigma obtuse. Ovules 4-6 in each cell. Drupe egg-shaped, 1' long. Seed solitary.

On the mountains of Oahu, rather common.

ORDER XVI. ZYGOPHYLLACEÆ.

Herbs or undershrubs, with opposite, mostly pinnate leaves. Sepals and petals 4 or 5, imbricated or convolute in æstivation, with the distinct stamens of the same number or 2 or 3 times as many (the filaments usually furnished with an internal scale). Styles united into one. Fruit berry-like, or of few or several, usually one-seeded, cocci, which are often spiny.

1. TRIBULUS Linn. [Nohu.]

Sepals 5, imbricated in æstivation, deciduous. Petals 5, entire, imbricated. Stamens 10, inserted at the base of the 10-lobed annular disk. Ovary 5 - 12-celled, with an equal number of stigmas on a short style. Ovules 1 - 5 in each cell. Fruit of 5 - 12 cocci, which are hard and spinescent, and indehiscent. Seed solitary in each cell. Albumen none. — Branched herbs (or often woody at the base), prostrate and spreading. Leaves opposite, abruptly pinnate, with stipules. Flowers solitary on peduncles, white or yellow.

A genus of several species, and found throughout the hot regions of the globe.

1. *T. CISTOIDES* Linn. (*Enum. No. 59.*) A trailing perennial herb or undershrub. Leaves 2' - 4' long, of from 5 - 10 pairs of leaflets, which are 3" - 8" long, oblong, acute or obtuse, softly silky-hairy on both sides, but whitish underneath. Peduncles nearly as long as the leaves. Flowers large, 1' - 2' in diameter, yellow. Petals broadly cuneate. Fruit 6" - 8" in diameter, the cocci bearing spines 2" long.

Near Diamond Hill, Oahu; on the sand, and in similar localities, frequent. Also from most of the Pacific Islands, the West Indies, Mexico, and tropical South America, &c.

ORDER XVII. GERANIACEÆ.

Herbs or shrubs with palmately veined and often lobed, or sometimes palmately compound leaves. Sepals 5, imbricated in æstivation.

[To be continued.]

VIII. *Observations on Polyzoa. Suborder Phylactolæmata.*

BY ALPHEUS HYATT.

[Continued from page 112.]

(4) The fourth, or epithelial layer envelopes the canal, as a whole, but is not adherent to the exterior. It passes in a straight line over the depression between the œsophagus and stomach, and is carried from the œsophagus to the intestine with but a slight anterior flexure (Pl. 10, fig. 1, Pl. 11, fig. 1). This adaptability of the fourth layer shows that it is accompanied by the same longitudinal muscular fibres which were observed to be associated with it in the endocyst of the polypide, and in the cœnœcium.

During the retraction of the polypide of *Pectinatella* the alimentary canal is bent upon itself towards the abdominal side, and the fourth layer contracts, so that when viewed laterally it appears in a straight line spanning the space between the lower portion of the œsophagus and the end of the stomach (Pl. 9, fig. 13, J''').

Allman defines three layers in the stomach; (1) an internal layer of easily separable spherical cells, filled with colorless fluids, in which float secondary cells with yellowish brown contents; (2) a more compact layer of smaller simple cells with colorless contents and brilliant nuclei; and (3) a thin membrane of an undoubtedly cellular structure. Of this last he says, "Delicate circular striæ may generally be distinctly observed in it; they may be seen surrounding the stomach, and are probably muscular fibres; they become less distinct as we ascend towards the œsophagus, and totally disappear from this tube and from the rectum."

The same author describes but two œsophagal membranes, which he considers the equivalents of the middle and external layers of the stomach. Although greatly advancing our knowledge of the tissues, this experienced observer did not see the fourth membrane, and failed in tracing his first membrane, equivalent to my first two, in the œsophagus, where, according to the description given above, it is quite as distinct as in the stomach, differ-

ing, however, in having cells with contents of a lighter color,

My observations with regard to the universality of the transverse striæ are confirmed by Hancock, who found them in both the stomach and œsophagus; whereas Allman, in the sentence just quoted, thinks that they are absent in the latter and in the walls of the intestine.

The digestive canal is simpler than in many of the lower polyzoa; it has neither the crop of *Laguncula*, or the cœcal appendages of *Flustra*, and is without special organs of secretion, except in so far as their places may be supplied by the cells of the first membrane.

The œsophagus is an open cylindrical cavity, invariably shorter and narrower than the stomach, the lower portion somewhat enlarged, the oral or upper part funnel shaped and ciliated (Pl. 7, fig. 5, Pl. 11, fig. 1, Pl. 12, fig. 1, K). The stomach may be typically considered as a single tubular cavity with an anterior flexure near the pyloric end, and the anterior side of this flexure prolonged into a gourd-like cœcum of great size and length (Pl. 7, fig. 5, Pl. 11, fig. 1, Pl. 12, fig. 1 K').

The intestine varies more in form than either the œsophagus or stomach, but is universally broad below and tapering towards the anus (Pl. 7, fig. 5, Pl. 11, fig. 1, Pl. 12, fig. 1, K'').

Two valves intercept free communication between the gastric cavity, and the œsophagus, and intestine (Pl. 7, fig. 5, Pl. 11, fig. 1, Pl. 12, fig. 1, K''', K''').

The first of these, the cardiac, or Œsophagal Valve, is a perforated coniform projection of the walls of the canal at the point of union between the œsophagus and stomach. The longer part being within the cavity of the stomach, and the apex directed anteriorly, it is usually sufficiently strong to prevent the regurgitation of the food. The second, the pyloric, or Intestinal Valve, has a similar structure, but is not so thick, and forms a flat partition between the two compartments.

The reception and elimination of nutritious material by this simple apparatus is among the most striking of the phenomena exhibited in the structure of these animals.

The food is gathered in the funnel-shaped part of the œsophagus until the increase in bulk enables the transverse muscular fibre of the third membrane to act. It is thence carried rapidly into the stomach by a peristaltic motion of the walls, the dividing valve opening for its admission.

The peristaltic motions still continuing push it to the fundus of the cœcum, and then passing over it reverse the direction of the motions, sweeping the whole mass back again to the œsophagal valve. Thus the food is alternately rolled from one end of the stomach to the other, or, rather, from what may be homologically designated the centre of the anterior side to the œsophagal end. Occasionally when transported with extraordinary violence against the upper barrier the valve gives way, becoming inverted, and the food pours into the œsophagus. It never, however, reaches the mouth, being invariably and almost instantly restored to the stomach.

The momentary pause of the annular wave at the anterior end of the huge cœcum and the fading out of the longitudinal rugæ and deep brown color of the internal layer in this part, induced Prof. Allman to describe it as differing in structure and function from the rest of the stomach. The fundus of the cœcum, however, resembles in these features, except in so far as they are modified to accord with its rounded surface, the intestinal and œsophagal extremities. The pause of the "hour-glass constriction," momentarily separating this region of the cavity, is consequent upon the large size of the cavity, and the peristaltic motions of the walls. These following up the food jam it against the bottom and cause a globular distension, which the contractile energy of the muscles cannot overcome until the diameter of the swelling is lessened; and while this is being effected by the forced return of part of the contents through the neck of the hour-glass, the anterior motion of the wave is necessarily arrested and a delusive aspect of permanence given to the constriction, which it does not really possess. Similar globular distensions do not characterize the posterior region of the stomach, because of the smaller diameter of that part, and

the weakness of the valve, which gives way before unusual pressure.

The eliminated nutriment transudes through the membranes of the stomach and intestine into the perigastric chamber, and there mingling with the circulating medium is conveyed by it to all parts of the body.

The residuum of the digested food is admitted gradually to the intestine through the intestinal valve, and assuming a more solid appearance, it is slowly discharged from the anus by the agency of the transverse parietal muscles.

These excrements are oval, and compounded of brownish colored refuse cemented by transparent gelatinous matter. They correspond in shape with the intestine, and have different forms according to the genus of the species, from which they are thrown off, being very much elongated in *Fredericella*, broader in proportion to the length in *Plumatella*, and very broad in *Pectinatella*, thus agreeing exactly with the gradual increase in the transverse diameter of the intestine from *Fredericella* to *Pectinatella*. In *Cristatella* they were not closely observed, but probably are more or less flattened in correspondence with the very flat intestine of that genus.

CIRCULATION.

The interior of the polypide and cœnœcium is filled with a colorless fluid which is kept in circulation by the cilia on the epithelial membrane. They cover the entire surface of the endocyst, including the ceiling of the lophophore; but, as previously observed by Professor Allman, do not occur upon the alimentary canal. There are two principal currents maintained in each polypide by these cilia, one passes posteriorly along the dorsal side, enters the arms, and, being deflected upon itself at their extremities, courses along the ceiling of the lophophore, and returns to the cœnœcium along the ventral side. These currents can be readily observed by the aid of the numerous organisms, many of them probably parasitic, which float in the fluid, sometimes in such numbers as to interfere with the examination of the inter-

nal structures. The intimate composition of the circulatory fluid is not accurately known, although supposed by Prof. Allman to consist mainly of water charged with the chyliferous exudations of the alimentary canal. This is the most reasonable view, though it is not known by what means the water enters the cœnœcial cavity. Prof. Allman observed, that the cœnœcium of *Lophopus* and *Cristatella* readily emptied themselves when taken out of water, and I have observed the same phenomenon in *Plumatella vitra*, which like *Lophopus* has a soft ectocyst.

The cœnœcia of these species, when exposed for any length of time, shrink to an almost imperceptible film, but upon being again returned to the water they expand to their former dimensions. The dessication must have been occasioned by the flow of fluid through the pores of the cœnœcial endocyst and the superincumbent ectocyst, since all the polypides were closely retracted. These facts show, that it is not necessary to look for an explanation of the admission of the water to any specialized orifices in the evaginable endocyst of polypide, but that in all probability the entire endocyst is pierced to a greater or less degree by aquiferous pores. These, however, in common with other observers who have sought for them, I have failed to detect.

RESPIRATION.

Our knowledge of this function and of the organs by which it is performed is also very limited.

Beyond the very probable fact that the tentacles are the principal respiratory organ, but little is definitely known. The structure of the first membrane of the endocyst investing them, covered as it is with cilia, and the homological identity of these parts with the well-known respiratory fringes of the *Brachiopoda* and the respiratory sack of the *Ascidia* show them to have similar functions. The first membrane, however, also extends over the external surface of the entire colony, and, although devoid of cilia, probably aids in aerating the circulating medium, whenever it is uncovered by the ectocyst. The admission of water to the interior is another means for keeping the

blood in a healthy state. It would be exceedingly interesting to determine precisely what part each of these plays in the aeration of the blood, but so far nothing has been done towards so desirable an end.

HOMOLOGIES.

A Polyzöoid, reduced to its simplest form, is a closed sac, the walls bent inwards forming an annular fold dividing the neural or posterior region from the reproductive or anterior region. The posterior end bears the lophophore, a disk bordered by the tentacular organs of respiration and prehension, and perforated by a circular edentulous mouth, from which hangs the digestive system in the antero-posterior axis of the sac beneath. The alimentary canal has a simple, dorsal flexure, the anus opening on the dorsal side near the mouth.

Animal compound; nervous system compound, each zoöid furnished with two large dorsal ganglia; * principal muscles distributed in pairs on either side, attached posteriorly to the alimentary canal and lophophore, and anteriorly to the walls of the reproductive region; circulation unconfined by special vessels; reproduction takes place by buds and by the ova.

Many malacologists consider the Polyzoa more nearly related to the Ascidia than to the Brachiopoda. The class characters of the Brachiopoda, however, and the special homologies, which may be traced between the organs of a Brachiopod and those of a Polyzöoid, show closer affinities than exist between the last and an Ascidian. The higher Brachiopoda, such as *Terebratula* and *Rhynchonella*, have the respiratory tentacles similarly situated around the disk, or lophophore, which is perforated at the centre by the mouth, and from which the alimentary canal hangs in the visceral sac beneath, the mouth and anus approximate, the canal having a dorsal flexure.

The extension of the lophophore into two or three spiriform arms, the complex structure of the tentacles and

* The existence of a complete nervous collar is doubtful.

of the muscular and nervous systems are all more or less foreshadowed by the condition of these systems among the higher Polyzoa.

Hancock, in his admirable memoir on the structure of the Brachiopoda, has described with great clearness the different steps in the complication of the arms. Beginning with their simplest aspect in *Fredericella*, and tracing them to *Plumatella*, he shows, that, if the tentacles of the latter were approximated, forming a double line on one side, and the arms elongated and twisted spirally, they would be essentially like those of the spiral armed Brachiopods.* In the same memoir he also homologizes the retractor and opercular muscles of *Paludicella* with the adjustor muscles of the Brachiopod on account of their similar functions, and the parietal band of the former genus with the parietal muscles of *Lingula*.

Although I regard functional resemblances as having but little weight in determining homologies, especially where organs, as in the case of the muscles, necessarily change their special office with every change in the position of the bases of attachment, I, nevertheless, agree with Mr. Hancock in his homologies with the exception of the retractors. These, as I shall presently endeavor to show, are the homologues of the oclusor and divaricator muscles of the Brachiopod.

Huxley, in his comprehensive article on the Molluscan Archetype, compares an Avicularian with a Brachiopod, remarking the sameness in the position, proportions, and articulations of the valves, and of the divaricator and oclusor muscles in both. He also agrees with Mr. Hancock in regarding the arms of the Polyzöid and Brachiopod as identical, but shows that they grow in opposite directions.† This opposition is better understood if we begin our comparison by imagining the *Terebratula* to be, as it really is, comparable with a permanently invaginated Polyzöid, and endeavor to modify an invaginated *Plumatella* accordingly. For this purpose the lophophore of

* Hancock. Brachiopoda. Phil. Trans. 1858, also Ann. and Mag. Nat. Hist. 1850, p. 198.

† Huxley. Encyclopedia, Art. Mollusca.

the Plumatella must be rotated anteriorly until it is parallel, as in the Brachiopoda, with the antero-posterior axis of the body; and this rotation must be towards the dorsal side, since upon this side lie the anus and the principal ganglia in both animals. After this operation is effected, there is no longer any room for the growth of the arms anteriorly, and they must extend, if developed at all, from the free posterior side of the disk.

The nearest approach to the Ascidian that can be attained by modifying, in a somewhat similar manner, the organization of a Polyzooid, is very clearly exhibited by Prof. Allman in two imaginary sections taken respectively from a Clavellina and a Plumatella.* He has faithfully preserved the natural peculiarities of the Polyzooid, and the comparison of these figures beautifully illustrates his homologies. Nevertheless, they do not appear to prove so close a resemblance as we have just shown to exist between the Terebratula and Plumatella. The arms, the single orifice, the tentacles, the lophophore, and the simple dorsal flexure of the alimentary canal, are necessarily retained in his diagram of the Plumatella. All of these are incompatible with the structure of the Ascidian, the general characters of the homologues of these parts in the latter being widely different. The flexure of the alimentary canal in the Ascidian is not simple but twisted on itself, the first flexure being towards the ventral instead of towards the dorsal side as among Polyzoa; and the only genus, Appendicularia, in which the canal has a simple flexure, as in Polyzoa, has the intestinal opening on the ventral instead of the dorsal side. The lophophore, fringed with tentacles and prolonged into brachial appendages, is also so obscurely represented, that it becomes difficult to trace out the homological parts. The construction of the sieve-like gill-sac of the Ascidian with its two orifices for the admission of pure water, and its emission mixed with the excrements, after passing through the meshes of the respiratory bars, could only be imitated in a diagram of a Polyzoön by radically altering the structure of the type.

* Allman, Op. cit.

We are, also, obliged to abandon any comparison between the muscular systems, which, although so complicated and prominent in the polyzoön, is entirely wanting in the Ascidian.

No such radical differences occur in the Brachiopod. It is only necessary to shift the positions of the various organs and follow out to their consummation in the higher group the structural changes indicated in the prototypical Polyzoön. The arms, the lophophore, the tentacles, the muscles, the simple dorsal flexure of the alimentary canal are all present, and occupy about the same relative positions.

By means of his diagrams Prof. Allman proves, that the organs of the *Plumatella*, equivalent to those of *Clavellina*, are respectively as follows: the ectocyst to the external tunic, the endocyst to the internal tunic, the calyx to the investing membrane of the branchial sac, the tentacles to the transverse respiratory bars of the branchial sac, the epistome to the "languettes."

Besides the homologies already quoted from Hancock and Huxley, I may add that the ectocyst, and endocyst also, are found in the Brachiopod.

If a section of a *Terebratula* be made along the antero-posterior axis, and compared with a similar section of an invaginated Polyzoöid, the number of tunics are the same. The shell is identical with the ectocyst, and has besides the columnar structure of the columnar, calcareous ectocyst of *Eschara*, which is similarly perforated by minute follicles.*

The mantle proper lining the shell is the same as the endocyst, which carpets the interior of the ectocyst in Polyzoön, and the inner side of the mantle corresponds to the invaginated polypidal endocyst, or tentacular sheath,

* Milne Edwards. *Ann. des Sciences Nat.*, vol. 6, 1836. The *Ascidia*, also, have similar processes, but these have afferent and efferent canals, and, as Dr. Carpenter in the *Proc. Royal Soc.*, vol. 7, p. 86, 1854, has pointed out, they do not resemble them closely in structure. The cœcal tubes of *Terebratula*, according to Hancock (*Op. cit.*), are only prolongations of the outer membrane, whereas those of *Eschara* open into the visceral cavity; thus neither in *Ascidia* or in *Brachiopoda* are they closely alike, although probably homologous organs in both.

the mouth of the shell being but an indefinitely widened cœnoecial orifice. The innermost membrane of the mantle surrounds the digestive organs of the *Terebratula* forming large blood sinuses on the œsophagus very much as it does in the cavity of *Pectinatella*, except that in the last no blood sinuses are defined.

The lophophore of *Terebratula* bends upwards at the base of the tentacles into a muscular ridge which incloses the mouth passing round it on the posterior side. This serves to convey the threads of food to the mouth, and would be the homologue of the epistome if it were properly situated.

The epistome of *Plumatella* is immediately over the ganglia and between the anus and mouth, whereas this fold, which so nearly resembles it in other respects, is on the opposite side of the mouth, and cannot, therefore, be its equivalent. It may be the homologue of the calyx, which has the same position with reference to the tentacles, and is, in like manner, a fold of the lophophore. Where there is such divergence in structure, however, the only conclusive facts are to be found in embryology, and until the solution of this difficulty is sought by the study of development, it will be difficult to determine, whether an organ corresponding to the calyx exists or not among the Brachiopoda.

The muscles of the *Terebratulæ* are in three sets, the oclusors, the divaricators, and the adjustors.* These sets are placed with reference to the alimentary canal and to each other as follows: the oclusors next to the canal, the divaricators intermediate, and the adjustors outside. These are their normal positions within the visceral cavity as determined by their bases of attachment. The ventral (dorsal) bases of the lower pair of adjustors are inside of the ventral bases of the oclusors; but this is not their normal condition, since the dorsal or corresponding pair of adjustors on the dorsal (ventral) side, the pedicle ends in all the allied genera, and the whole length of the ventral pair in *Waldheimia australis*

* Hancock, Op. cit.

and *Rhynchonella psittacea* may be looked upon as relatively outside of the divaricators.

The similarity between these three sets and the retractors and retentors of a *Plumatella* may be readily shown, if we bear in mind that the invaginated specimen compared on page 151 with a Brachiopod was rotated towards the dorsal side. If we suppose that only the muscles attached to the lophophore, the retractors, partook of its rotation, it is evident, that the posterior lophophoric extremities of the retractors became dorsal, and the anterior ventral, while the retentors were left comparatively unchanged, running in the direction of the antero-posterior axis.

The oclusors of *Terebratula* are in two distinct pairs on the ventral side, but each lateral pair blends into one stock and inclines inwards as it passes dorsally, and they have the alimentary canal between them. The gastric and œsophageal retractors of *Plumatella* make up two distinct pairs more or less intimately connected throughout, but widely separated at the anterior end, and inclining towards each other as they pass posteriorly; they also have the alimentary canal between them.

The divaricators of *Terebratula* are an independent pair next to the oclusors, spread out, however, in allied forms into two pairs on the dorsal side.

The brachial retractors of *Plumatella* are also an independent pair, spread out into numerous fibres at the posterior end, and closely gathered together below, and are next to the œsophageal.

The adjustors are in four pairs, arranged in nearly parallel bands outside of all the other muscles, and run towards the posterior end.

The retentors of *Plumatella* are arranged in nearly parallel bands, but are not separated into pairs because the coenœcial orifice is not widened laterally, and, therefore, does not divide them into a dorsal and ventral set as in *Terebratula*. They are also outside of all the other muscles, and run towards the posterior end.

Mr. Hancock, as previously remarked,* also homolo-

* Hancock, Ann. and Mag. Nat. Hist., 1850.

gizes the parietal muscles of *Paludicella* with the parietal muscles of *Lingula*.

The parietal muscles of the former genus are merely local developments of the transverse muscular fibres of the third layer similar to the less prominent bands occasioning the annular folds in the cœnœcium of *Plumatella* (Pl. 8, fig. 10). Mr. Hancock, although he has pointed out the identity of the adjustors of the Brachiopod with the so-called opercular muscles (retentors) of *Bowerbankia* and *Paludicella*, denies the existence of the opercular muscles in *Fredericella*. He describes and figures the retentors, but does not consider them, although similarly situated in the neighborhood of the orifice, to be the equivalents of the opercular muscles of *Bowerbankia* and *Paludicella* on account of their great functional divergence. I have failed to find any great functional divergence between the muscles of the orifice in *Paludicella* and *Fredericella*. The only difference between them appears to be, that in *Paludicella* they are fewer in number and retain two folds of the endocyst from complete evagination instead of one, and in *Bowerbankia* they do not retain any fold, only becoming active when the polypide is invaginated. They perform nearly about the same function in all these genera, the invagination of the lower part of the evaginable endocyst, the differences are those of degree only.

Facts of position, being always of determinate value, are more reliable than functional resemblances, however close they may be; for although the latter often afford a clue to the true homology, they furnish, in the present state of our knowledge, but a very precarious means for estimating the degree of similarity between the parts of different animals. Functionally, for example, the muscles of an Avicularian are as widely separable from those of the normal forms on the same stock, as the oclusors and divaricators of the Brachiopod from the retractors of the Polyzöid. They open and close the valve of a shell instead of retracting a polypide. Such an extravagant divergence between identical organs in two zooids of the same compound form is decisive against the adop-

SYNOPTICAL TABLE.

FREDERICELLIDÆ.		PLUMATELLIDÆ.		CRISTATELLIDÆ.	
FREDERICELLA.		LOPHOPUS.		CRISTATELLA.	
Cenocodium,	single or radiatory, adherent, natural position horizontal and erect, branching, diffuse or tubular, perfectly formed,	radiatory, adherent, erect, branching, lobate, more of their length lost in the cenocelial trunk,	radiatory, adherent, horizontal, branching, lobate, yet more of their length lost in the cenocelial trunk,	radiatory, free and locomotive, horizontal.	
Cenocelial Branches,	distinct, walls entire,	large portion of the walls obliterated, folds coalesce and multiply colonies,	walls obliterated, folds coalesce and multiply colonies,	wholly lost or merged in the cenocelial trunk.	
Cenocelial Cells,	irregularly divided by permanent, internal folds,	thin or thick, pergameneous or gelatinous, brown or colorless, permanent during the life of the colony, envelopes the entire cenocodium,	very thick, gelatinous, colorless, diminishes to a thin sheet in the old, found only on the underside, large and prominent,	thin again, gelatinous, colorless, becomes a transient excretion, found only on the underside, large and more prominent.	
Ectocyst,	cells of the first layer small, depressed, fully developed, 3d and 4th layers adhere to the 2d membrane throughout, fifth membrane adheres to the muscular layers throughout, fully developed, fixed and free, bean-shaped and elliptical,	cells of the second layer fully developed, 3d and 4th layers adhere to the 2d membrane throughout, fifth membrane adheres to the muscular layers throughout, fully developed, fixed and free, elliptical,	cells of the second layer fully developed, 3d and 4th layers adhere to the 2d membrane throughout, fifth membrane adheres to the muscular layers throughout, only the free forms, depressed or elongated ellipses, annulated, breadth .8 m m to 1, length .866 m m to 1, bent at the ends,	cells of the second layer fully developed, these layers bend inwards and form the reticulated walls, fifth membrane adheres to the muscular layers throughout, fully developed, fixed and free, elliptical.	
Cenocelial Endocyst,	bean-shaped, depressed or elongated ellipses, breadth .108 m m to .360, length .316 m m to .5,	decidedly bent at the ends, straight on the sides, pointed at the ends,	bent on the sides, rounded at the ends, one row, rough annulus, arises from statoblast,	orbicular, annulated, diameter .8 m m to .883, straight, straight, round, external, arises from statoblast.	
Funiculus, Statoblasts, Fixed Statoblasts,					
Free Statoblasts,					
Annulus,					
Spines,					

Cenocelial, or Reproductive Region.

tion of similarity in function as a criterion for the decision of homologies.

The development of the *Ascidia* has been deemed closely analogous to the development of the Polyzoa, and the separation of the walls of the branchial cavity from those of the surrounding thoracic chamber in *Ascidia* has been compared by Prof. Allman with the growth of the lophophore in Polyzoa.

The recent investigations of Fritz Müller show, that at one period of its life the Brachiopod has four arms or tentacles arranged in a radiatory manner about the mouth. These parts are borne upon a retractile proboscis, which has some resemblance to the evaginable tube of a Polyzoon.*

His researches, however, did not extend to the earliest periods of growth, and it remains to be seen how far these resemblances are matters of affinity or analogy, and to what degree the young of the Brachiopod really repeats the peculiarities of the adult Polyzoid.

EXPLANATION OF TABLE.

The three systems, as they are presented in the synopsis, may be read in two ways, either with regard to the mutual connection of organs in the individual, or with regard to their serial relations in the group. Thus by reading from the top to the bottom of any one column, a view of the structure both of the genus and of the individual is obtainable, the organs being described in regular order, according to their place in the body, from the anterior to the posterior pole. Or, by reading from left to right in the usual manner, an organ or a system may be traced through its entire series of changes in the different genera, until we reach *Cristatella*.

This table was made at the commencement of my investigations, with no intention of publishing it until a

*Fritz Müller, *Archiv. für Anat. Relchart et Du Bois Raymond*, p. 72, 1860.

very full list of species had been consulted; but the results so much surpassed my anticipations, that I have given it now, hoping the logical sequence of the whole, rather than the perfection of the details, would justify its introduction in this place.

The genus *Lophopus* is omitted with the exception of the "Cœnœcial Characters," which are quoted from various European authors, every effort on my part to find or obtain a single specimen having been unsuccessful. Nevertheless, the *Pectinatella* on one side, and the *Plumatella* on the other, show very plainly that it must have an intermediate character with regard to the polypide and the parts omitted. The following pages are intended as an explanation of the characteristics noted in the table, and should be read in connection with it.

CŒNŒCIAL SYSTEM.

CŒNŒCIUM.

Single or radiatory. The young colony of any one species of *Fredericella* may have (1) two or more polypides growing in opposite directions and simultaneously branching, or (2) they may spring from one polypide alone. (1) In this way a colony arises growing equally from the centre, with at least two compound branches, the polypides turning the open side of the lophophoric crescent toward the centre, and is truly radiatory. (2) By the last method, however, only one compound branch is formed, and the colony is one-sided or single. *Fredericella Walcotii* has, perhaps, fewer radiatory colonies than any other species of that genus, *Fredericella Pulcherrima* and *Fredericella regina* being very generally radiatory. There are, nevertheless, many single colonies in both of the last-named species, but they are not so frequently met with as the truly radiatory cœnœcia.

The single colonies mingle more or less with the radiatory in all four of the American *Plumatellæ*. The first are most numerous and constant in variety as *Plumatella vitrea*.

All the figures of *Lophopus crystallinus* are radiatory,

but it cannot be said with certainty, that all the individuals of the species are the same, since no direct observations have been made upon this character. Perfect radiation is essential to the structure of *Pectinatella* and *Cristatella*. The internal divisions, and the regular outlines of the coenecia give a more decided radiation to the colonies of *Pectinatella* and *Cristatella* than to those of preceding genera.

This more perfectly radiatory arrangement is directly traceable to the larger number of buds developed from the original cell, since instead of one or two buds as in *Fredericella*, there are five or more which spring from the walls of the primary cells in *Pectinatella*, and in *Cristatella* probably even a larger number. This radiatory character, therefore, which distinguishes individual varieties in *Fredericella* and *Plumatella*, is of generic value in *Pectinatella* and *Cristatella*.

Adherent. The hardness of the ectocyst determines the tenacity with which the branches cling to surfaces. The brown, horny ectocyst of the *Fredericellæ* anchor them very firmly; but there are some transparent colonies in this genus, and these are not so strongly fastened; in *Fredericella pulcherrima* the latter are quite numerous. Among the *Plumatellæ* there are more or less of the transparent colonies in every variety, and *Plumatella vesicularis* and *P. vitrea* have, in all cases, transparent ectocysts.

According to Prof. Allman, the gelatinous ectocyst of *Lophopus* is easily detached, and the ectocysts of *Pectinatella* or *Cristatella* are by no means as tenacious of their hold upon the surface as the ordinary brown ectocyst of the *Plumatellæ*. The hardness of the ectocyst, also, determines the tenacity with which it and the endocyst cling together. In *Pectinatella* the endocyst readily separates from the gelatinous base, and *Cristatella* moves freely upon the surface of its own ectocyst. The ectocyst and endocyst of variety *c* of *Plumatella vitrea* invariably separate when treated with alcohol. In the brown varieties of *Fredericella* and *Plumatella* such a rupture is much more difficult to accomplish.

Thus the adherence of the endocyst to the ectocyst, and the adherence of the latter to the surface, both depend upon the gelatinous nature of the ectocyst, which, as we have just seen, is characteristic of varieties in *Fredericella* of some species in *Plumatella*, and of the genus in *Pectinatella* and *Cristatella*.

Natural position erect or horizontal. The single colonies in any species of *Fredericella* are as apt to have free and erect branches, as to have them wholly attached and horizontal. The free branches, however, are rarely seen in *Plumatella arethusa*, and I have not observed them in *P. diffusa*, *vesicularis*, and *vitrea*, though it is quite probable that they may be found more or less in the brown variety of *P. diffusa*. They are also, doubtless, found in *P. nitida*, which is a luxuriant growth.

Lophopus, both in this country and in Europe, is erect. *Pectinatella* and *Cristatella* are invariably horizontal. The position of the branches is therefore of generic value in the last three genera, and of variable value in *Fredericella* and *Plumatella*.

Branching. I have not yet found an adult colony without branches either in *Fredericella* or *Plumatella*. There are, however, very few branches on the colonies of variety b of *Plumatella vitrea*.

Although the number of branches and branchlets in the two lower genera are often less, they are, in the majority of the full-grown individuals, more numerous, amounting in some specimens of *P. Arethusa*, *P. diffusa*, and *P. vesicularis* to over fifty; and in variety c, of *Fredericella Regina* and *P. Arethusa*, they probably reach hundreds.

The lobes of *Pectinatella* rarely exceed ten, with about two or three branchlets to each, making in all thirty branches large and small.

The indefinite multiplication of the branches in *Pectinatella* is prevented by the frequency of self-division, which limits the size of the colonies, while greatly increasing their number. In *Cristatella* this characteristic disappears.

IX. *Flora of the Hawaiian Islands.*

BY HORACE MANN.

[Continued from page 144.]

Petals 5, convolute in æstivation. Stamens as many, or twice or thrice as many as the petals (or in one group 8). — A diversified order including several well-defined tribes, of which those represented with us are distinguished as follows: —

GERANIEÆ. Flowers regular, or nearly so. Five glands alternate with the petals. Stamens equal in number, or 2–3 times as many as the petals. Ovary of five 2-ovuled carpels, attached to the base of an elongated axis, to which the styles cohere. In fruit the distinct one-seeded carpels separate from the axis, by the curling back of the persistent indurated style from the base upwards. Embryo filling the seed (no albumen). — Largely represented in gardens by the so-called *Geraniums* which belong to the Cape of Good Hope genus *Pelargonium*, which has slightly irregular flowers.

TROPÆOLEÆ. Flowers very irregular. The lower sepal spurred. The two upper petals remote from the 3 lower, which are stalked. Stamens 8. — Leaves peltate. Only represented with us by the genus *Tropæolum*, or the Garden Nasturtium of South America, in cultivation.

OXALIDÆÆ. Flowers regular. Glands none. Stigmas capitate. Ovary forming in fruit a five-lobed and five-celled and many-seeded capsule. — Leaves compound.

1. **GERANIUM** Linn.

Flowers regular. Sepals 5. Petals 5, hypogynous. Glands 5, alternate with the petals. Stamens 10, all anther-bearing or very rarely 5 without anthers, free or connate at the base. Ovary 5-celled, beaked, the beak split into 5 styles with longitudinally stigmatic apices. Ovules 2 in each cell. Lobes of the capsule 1-seeded, septifragally dehiscent from the placentiferous axis, the end elastically rolling up from base to apex. Seeds without albumen: embryo with the radicle induplicately folded into the cotyledons, or incumbent upon them. — Herbs, rarely shrubs (in one case a small tree). Branches swollen at the nodes. Leaves opposite or alternate, stipulate, toothed or palmate, or rarely pinnately lobed and cut. Peduncles axillary, 1–2-rarely many-flowered.

Subgenus, **NEUROPHYILLODES**: peduncles often many-flowered; stamens wholly or nearly separate; leaves all alternate, ovate-cuneate, and nervose. — A remarkable group of plants, peculiar to the Hawaiian Islands, all shrubby, and one a small tree. They are distinguished

from all other *Geraniums* by their wedge-shaped or oval and parallel-nerved leaves.

A large genus, found throughout the temperate regions, and in the mountains of the tropics in some parts of the globe.

Leaves green, softly hairy.

Leaves ovate, obtuse, cuneate at the base, 1. *G. multiflorum*.

Leaves ovate-acuminate, cordate at the base, 4. *G. arborescens*.

Leaves silky-canescens on both sides, or glabrate.

Leaves ovate, and serrate at the apex and on the sides, 3. *G. ovatifolium*.

Leaves cuneate, serrate at the apex, and entire on the sides, 2. *G. cuneatum*.

1. *G. MULTIFLORUM* Gray. (*Enum. No. 60.*) An undershrub; the branches, peduncles, leaves, &c., softly pubescent with fine and spreading hairs. Leaves approximate, membranaceous, roundish-obovate, $1\frac{1}{2}$ ' long, 1' or more wide, coarsely toothed except the more or less cuneate base, green on both sides, 7-9-nerved from the base, the nerves more or less forked, and connected by anastomosing veinlets. Petioles $\frac{1}{2}$ '-1' long. Stipules setaceous-subulate from a dilated and connate-clasping base, minutely ciliate, scarious, brownish, 4''-5'' long. Peduncle becoming lateral by the growth of the branch, elongated (3' long), bibracteolate at the middle and at the summit, where it branches into a repeatedly trichotomous, open, loose, and many-flowered cyme. Bracts ovate-lanceolate, subulate, scarious. Internodes of the cyme $\frac{1}{2}$ '-1' long; pedicels 1''-3'' long, erect in flower and fruit. Sepals pubescent, ovate-oblong, mucronate, 3''-4'' long. Petals obovate, entire, a little longer than the calyx. Stamens 10, all alike; filaments distinct. Ovary and beak ($\frac{1}{2}$ ' long) pubescent.

District of Waimea, Hawaii.

2. *G. CUNEATUM* Hook. (*Enum. No. 61.*) A shrub 1°-2° or more high, much branched; branches thickly beset with the scaly and persistent stipules. Leaves crowded, coriaceous, $\frac{1}{2}$ '-1 $\frac{1}{2}$ ' long, $\frac{1}{2}$ '- $\frac{3}{4}$ ' wide, wedge-shaped, the apex truncate and 3-5-toothed, tapering to an acute base, the sides entire, strongly 5-7-nerved, nerves mostly simple and parallel. Petiole 2''-3'' long. Peduncles terminal or opposite the leaves, short or often elongated, cymosely 5-12-flowered, or by abortion 1-3-flowered; the peduncles, &c., many-bracted, the bracts subulate, small. Pedicels $\frac{1}{2}$ '- $\frac{3}{4}$ ' long. Sepals 2''-3'' long, ovate or oblong-ovate, barely mucronate. Petals white, obovate, 4''-5'' long. Stamens as in *G. multiflorum*.—Var. *MENZIESII*: leaves green and nearly glabrous on both sides, as is the calyx. The young branches, petioles and peduncles, &c., minutely puberulent.—Var. *HYPOLEUCUM*: plant decumbent and spreading. Leaves densely silky below, either white or yellowish, as is the outside of the calyx; above dark green, with silkyness on the nerves; or plant upright, leaves green above.—Var. *HOLOLEUCUM*: leaves finely silky on both sides,

white beneath, a little duller above. Branches and peduncles puberulent. Pedicels, bracts, calyces, &c., white silky.

HAB. Var. 1, on the high central plateau of Hawaii. Var. 2, the decumbent form on the summits of the mountains of Kauai and West Maui, in cold and wet soil; the upright form from the highlands of Hawaii. Var. 3, on the unwooded slopes of Haleakala, East Maui, at an elevation of 7,000 feet and more.

3. *G. OVATIFOLIUM* Gray. (*Enum. No. 62.*) Shrub 2°-3° high, branches clothed with the stipules as in the preceding species. Leaves chartaceous or coriaceous, ovate, more or less acute, sharply and finely serrate with mucronate teeth except towards the entire base, 1'-2½' long, 7-11-nerved, the upper surface somewhat glabrate and green with age, below whitened with a silky pubescence. Petioles slender, ¼'-1½' long, pubescent. Peduncles opposite the leaves, 3-7-flowered, or sometimes only 1-flowered, about 1' long. Sepals ovate-oblong, mucronulate, sometimes tinged with purple. Petals white with purple veins.

North side of the upper region of Haleakala, East Maui.

4. *G. ARBOREUM* Gray. (*Enum. No. 63.*) Arborescent, the trunk 6°-12° high, 4' or more in diameter. Branchlets squarrose with the persistent stipules, which are like those of the preceding species, when young pubescent with soft hairs, as are the leaves, peduncles, calyx, &c. Leaves chartaceous or membranaceous, ovate or oval, obtuse or acute, rounded and subcordate at the base, sharply serrate, about 7-nerved, greenish on both sides, more or less glabrate with age, 1'-1½' long, 1', more or less, in width. Petioles 3''-8'' long. Peduncles 1-2-flowered, or perhaps more, terminal or opposite the leaves, ¼'-1' long, subulate-bracted. Flowers larger than the other species. Sepals oblong or oblong-lanceolate, abruptly awn-pointed, 6'' long. Petals red, obovate-spatulate, 8''-10'' long, the three upper more upright and cucullate. — A remarkable species.

Upper border of the woods above Ulupalakua, East Maui, at 6,000 feet elevation.

2. *OXALIS* Linn.

Flowers regular. Sepals 5. Petals 5. Glands none. Stamens 10, free or connate at the base, all anther-bearing. Ovary 5-celled, with a very short beak; styles 5, distinct: stigmas terminal, capitate, bifid. Ovules 1-many in each cell. Capsule loculicidally dehiscent, opening at the angles of the valves which remain adhering to the axis. — Herbs or rarely shrubs. Leaves radical or cauline, alternate, digitately or palmately 3-many-foliolate, the leaflets entire or 2-lobed. Peduncles axillary or radical, 1-flowered, or often cymosely or umbellately many-flowered.

A large genus, chiefly American and African, with a few Asiatic species.

1. *O. CORNICULATA* Linn. (Enum. No. 64.) A decumbent, prostrate or ascending, much-branched delicate perennial, or sometimes annual, more or less pubescent, of a pale green, from a few inches to a foot long. Stipules small, adnate to the petiole. Leaves alternate; the petioles about 1' long. Leaflets 3, digitate, broadly obcordate, usually 3''-4'' long. Peduncles axillary, about the length of the petioles, bearing an umbel of 2-6 small yellow flowers on reflexed pedicels 3''-4'' long. Capsule column-like, $\frac{1}{2}$ ' or more long, with several seeds in each cell.

In waste places; probably introduced, but firmly established. A common weed in all but the colder regions of the globe.

2. *O. MARTIANA* Zucc. (Enum. No. 65.) A stemless herb, with a compound bulbous rhizome, covered with brown 8-ribbed scales. Leaves radical, slightly hairy; the petioles 4'-6' long. Leaflets 3, digitate, broadly obovate-emarginate, 8''-10'' long. Peduncles radical, rather longer than the petioles, bearing a single umbel, or more frequently irregularly divided into 2 or 3 branches, each bearing 1-2 umbels of pale-purplish flowers. Sepals obtuse, with 2 small glands at the tip, 2''-2 $\frac{1}{2}$ '' long. Petals glabrous, 3 or 4 times as long as the sepals. Stamens and style pubescent.

Moist places in Nuuanu Valley, Oahu; probably escaped from gardens. A native of Southern Brazil.

ORDER XVIII. RUTACEÆ.

Herbs, shrubs, or trees; the leaves punctate with pellucid dots, and without stipules. Calyx of 4 or 5 sepals. Petals 4 or 5, or rarely fewer or none. Stamens as many or twice as many as the petals, inserted on the outside of a hypogynous disk. Ovary 3-5-lobed, as many celled, with the styles united, or distinct only at the base, or the ovaries nearly separate, during ripening usually separating into the component carpels, which are dehiscent by one or both sutures; the chartaceous endocarp separating from the woody exocarp. Seeds few or single, mostly with albumen; and a curved embryo. — *Aurantaceæ*, an Order combined by some botanists with *Rutaceæ*, from which it differs in its berry-like fruit with a rind, and its seeds without albumen, furnishes the Orange, Lime, Lemon, &c.

Leaves simple.

Stamens all free and distinct.

Petals valvate, 1. *PELEA*.

Petals slightly imbricate, 2. *MELICOPÆ*.

Stamens monadelphous below the middle, 3. *PLATYDESMA*.

Leaves pinnate, 4. *ZANTHOXYLUM*.

1. *PELEA* Gray.

Flowers polygamous. Sepals 4, imbricate. Petals 4, valvate.

Stamens 8, filaments subulate or flattened, often quite short in the fertile flowers. Hypogynous disk short, entire or eight-crenulate. Ovary 4-celled (the cells opposite the petals) 4-lobed, often umbilicate; style central; stigma 4-lobed. Ovules 2 in each cell, hemitropous. Capsule 4-parted, the cocci divaricate, loculicidally dehiscent. Seeds usually 2 in each cell, ovoid, with a shining, black testa. Embryo straight, in fleshy albumen; cotyledons oval. — Unarmed trees; with a heavy odor. Leaves simple, entire, opposite or whorled, coriaceous, very veiny, the veins uniting in a more or less distinct intramarginal one. Flowers axillary.

A small genus, peculiar to the Hawaiian Islands (or perhaps one in the Samoan Islands).

Leaves whorled; flowers fasciated in the axils on short peduncles.

- Leaves petioled, entirely glabrous, 1. *P. clusiæfolia*.
- Leaves petioled, pubescent beneath, 2. *P. sapotæfolia*.
- Leaves sessile by an auricled base, 3. *P. auriculæfolia*.

Leaves opposite; branches glabrous.

- Leaves velvety-villous beneath; coriaceous, 4. *P. kavaiensis*.
- Leaves glabrous; rather thin, 5. *P. anisata*.
- Leaves glabrous, coriaceous, oblong, petioled, 6. *P. oblongifolia*.
- Leaves glabrous, coriaceous, orbicular, sessile, 7. *P. rotundifolia*.

Leaves opposite; branches hirsute-tomentose.

- Leaves oval or oblong, strongly reticulated and glabrous beneath, 8. *P. sandwicensis*.
- Leaves oval, beneath slightly hirsute, 9. *P. volcanica*.

1. *P. CLUSIÆFOLIA* Gray. (*Enum. No. 66.*) A small tree, 20°, more or less, high, as are all the species of the genus. Glabrous throughout. Leaves verticillate in fours or threes, rarely opposite, coriaceous, obovate or obovate-oblong, obtuse or retuse, more or less acute at the base, pale, 2'–3' or more long, 8''–20'' wide; veins straight and parallel. Flowers in axillary subsessile clusters, the short pedicels becoming 2''–4'' long in fruit. Calyx lobes ovate, membranaceous, obtuse, 1½'' long. Petals ovate-lanceolate, 3'' long, wax-colored. Stamens shorter than the petals. Ovary glabrous, four-lobed, shorter than the style which arises from its umbilicate apex: stigmas 4, thick and short. Capsule obtusely 4-lobed, ½' or more in diameter. The thin and papery endocarp glabrous within. Seeds 1–2 in each cell, black and shining, 1½''–2'' in diameter.

Mountains behind Honolulu, and Kaala Mountains, Oahu. Windward slopes of Mauna Kea, and district of Puna, Hawaii.

2. *P. SAPOTÆFOLIA* H. Mann. (*Enum. No. 67.*) The young naked leaf-buds hirsute, as in all the species. Branches and inflorescence glabrous. Leaves 4 in a whorl, elongated-oblong or spatulate-oblong, chartaceous, 4'–9' long, 2'–3' wide, attenuated or somewhat obtuse at the base, on petioles 1½' long, villous-pubescent beneath, quite glabrous above. Flowers in axillary sessile clusters, the pedicels 2''–3''

long. Calyx lobes broadly ovate, $1\frac{1}{2}$ " long. Petals ovate, 2" long. Stamens much shorter than the petals. Ovary glabrous; style a little longer than it, 4-parted nearly to the base, the divisions clavate, stigmatic at and near the summit. Immature capsule puberulent and deeply 4-grooved.

Valleys of Kealia and Hanalei, Kauai.

3. *P. AURICULIFOLIA* Gray. (*Enum. No. 68.*) Glabrous. Leaves verticillate in threes, coriaceous, pale, oblong-spatulate, auriculate at the narrowed base, sessile, 8' - 8' long. Flowers in fascicles in the axils of the leaves, often of those which have fallen, so as to be on the naked stem. Capsule deeply 4-parted; the cocci oval-oblong.

Mauna Kea, and Kohala Mountains, Hawaii.

4. *P. KAVAIENSIS* H. Mann. (*Enum. No. 69.*) Leaves opposite, oval, $2\frac{1}{4}$ ' - 4' long, $1\frac{1}{4}$ - $2\frac{1}{4}$ wide, coriaceous, glabrous and very conspicuously and finely reticulate-veiny above, beneath clothed with a dense velvety villosity, which is especially thick on the midrib. Petioles $\frac{1}{4}$ ' - 1' long. Flowers small, solitary in the axils, on slender pedicels 2" long. Calyx lobes rounded-ovate, $\frac{1}{4}$ " long. Petals thin, ovate, obtuse, $1\frac{1}{4}$ " long. Stamens short. Style about the length of the glabrous ovary, terminated by an obtusely 4-lobed stigma. Capsule 4-parted, one or more of the ovate glabrous cocci often abortive.

On the mountains above Waimea, Kauai, at an elevation of 3,000 feet, more or less, at "Halemanu."

5. *P. ANISATA* H. Mann. (*Enum. No. 70.*) Leaves elongated-oval or oblong, obtuse, somewhat attenuated at the base, 2' - 7' long, 1' - 2' wide, chartaceous, loosely reticulate-veined. Petioles $\frac{1}{4}$ ' - 1' long. Flowers usually solitary in the axils, rarely 2 or 3 together, on pedicels 1" - 2" long. Calyx-lobes ovate, obtuse, less than 1" long. Petals oblong or oblong-ovate, thrice the length of the sepals. Stamens very short, not exceeding the calyx-lobes. Ovary glabrous and slightly lobed. Capsule but slightly 4-lobed, $\frac{1}{4}$ ' in diameter, splitting by a loculicidal dehiscence to the centre into four triangular segments joined at the base. Exocarp thick and woody: endocarp papery and smooth within.

On various parts of Kauai, but most abundant near Hanalei. Native name, "Maki-hana."

6. *P. OBLONGIFOLIA* Gray. (*Enum. No. 71.*) A very variable species. Leaves oblong or oval, contracted towards the base, or obtuse or even retuse at both ends, coriaceous or chartaceo-coriaceous, somewhat shining, copiously and conspicuously feather-veined, and minutely reticulated, 2' - 4' long, on petioles 6" - 9" or more long. Pe-

duncles shorter, or those bearing sterile flowers longer, than the petioles, 1-few-flowered, more or less clustered or loosely cymose. Calyx-lobes ovate, a third as long as the ovate-lanceolate petals. Style twice as long as the glabrous 4-lobed ovary. Capsule deeply 4-lobed, an inch, more or less, in diameter.

Mountains of Oahu, in various parts. Kaula. Hawaii.

7. *P. ROTUNDIFOLIA* Gray. (*Enum. No. 72.*) Glabrous. Leaves orbicular or nearly so, about $2\frac{1}{2}'$ – $3'$ in diameter, sessile, coriaceous, rather shining, very velvety and reticulated, especially beneath. Flowers several in a short-peduncled cyme. Calyx lobes ovate, more than one-half shorter than the petals which are $3''$ long. Style twice as long as the puberulent ovary. Capsule $1'$ in diameter, deeply 4-lobed; the cocci oval. Endocarp minutely puberulent within.

Mountains behind Honolulu, Oahu.

8. *P. SANDWICENSIS* Gray. (*Enum. No. 73.*) Glabrous at maturity or nearly so, but the new branchlets, inflorescence, &c., tomentose with a hirsute pubescence. Leaves oval or oblong, $2\frac{1}{2}'$ – $4\frac{1}{2}'$ long, $1\frac{1}{2}'$ – $2\frac{1}{2}'$ wide, very coriaceous, glabrous, or sometimes puberulent beneath, especially on the very thick midrib, very veiny and reticulated. Petioles stout, $7''$ – $15''$ long. Cymes short peduncled, 3-several flowered. Pedicels short, annulate by the broad scars of the ovate-subulate bracts. Flowers $1\frac{1}{2}''$ long. Calyx-lobes round ovate, half the length of the petals. Style usually longer than the tomentose, deeply 4-lobed ovary; stigma 4-lobed. Capsule finely tomentose, $1\frac{1}{2}'$ or more in diameter, deeply 4-lobed; cocci oval. The papery endocarp finely pubescent within.

Mountains behind Honolulu, Oahu. West Maui, on the mountains.

9. *P. VOLCANICA* Gray. (*Enum. No. 74.*) A tree sometimes 40 feet high, the trunk a foot and a half in diameter. Young branches, &c., tomentose with a hirsute pubescence, which disappears with age. Leaves oval, $4'$ – $8'$ long, $2'$ – $3\frac{1}{2}'$ wide, obtuse at both ends, coriaceous, glabrous above, below sparsely hirsute. Petioles stout, $1\frac{1}{2}'$ – $2'$ long. Peduncles axillary, $\frac{1}{2}'$ – $1\frac{1}{2}'$ long, bearing a loosely few-flowered, paniculate cyme. Pedicels stout, $1''$ – $2''$ long. Calyx-lobes ovate, canescently pubescent as are the petals, though more sparingly so, and one half the length of the latter, which are $3''$ long and ovate-lanceolate. Ovary tomentose, as long as the style; stigma 4-lobed. Capsule large, $1\frac{1}{2}'$ in diameter or even more, one or more of the cocci often abortive. The cocci glabrous, more or less laterally flattened, acute or carinate at the sutures. Endocarp glabrous within.

Forests of Mauna Kea, Hawaii. Kaala Mountains, Oahu.

2. MELICOPE Forst.

The same in all points as *Pelea*, excepting the æstivation of the corolla, which is imbricate; and the leaves in some Australasian species are 1-3-foliolate: they are simple in the Hawaiian species. (Vide H. Mann, in Proceed. Bost. Soc. Nat. Hist., Vol. X. p. 316.)

1. *M. CINEREA* Gray. (*Enum. No. 75.*) A small tree 20° more or less in height, as are all the species of the genus, with the general habit of *Pelea*. Leaves oblong, obtuse, the rounded base retuse, coriaceous, pale, puberulent, as also the young branches, petioles, &c., with a fine tomentum, which is persistent beneath; pinnately veined, slightly reticulated, 4'-5' long, 1'-2' broad. Petiole 9"-10" long, narrowly margined. Peduncles axillary, solitary, short, canescent, several-flowered. Calyx-lobes silky, half as long as the silky petals, which are 3" long. Ovary puberulent; style short; stigmas 4, capitate. Capsule 4-lobed, $\frac{1}{4}$ ' or more in diameter.

Kaala Mountains, Oahu.

2. *M. BARBIGERA* Gray. (*Enum. No. 76.*) The younger branches, petioles, leaves, &c., minutely puberulent. Leaves oblong and obtuse at both ends, green, shining, and glabrous above, beneath densely villous-bearded with very long hairs along the midrib, and scattered and more deciduous ones over the lower surface; thin-coriaceous, curved, and the upper surface convex, the lower concave. Petioles an inch or more long, margined. Peduncle shorter than the petioles, 1-few-flowered. Sepals ovate-lanceolate, acute, puberulent, a little shorter than the puberulent ovate-lanceolate petals, and 3" long. Capsule entirely divided into 4 lenticular-ovoid follicles, which are divaricate, sessile, and $\frac{1}{4}$ ' or more long.

Mountains above Waimea, Kauai, about 3,000 feet, near "Halemanu."

3. *M. SPATHULATA* Gray. (*Enum. No. 77.*) Glabrous. Leaves coriaceous, elongated, spatulate-oblong, or oblanceolate, obtuse, tapering to an acute base, 3'-6' long, 1'-2' wide, pale and dull, inconspicuously feather-veined. Petiole 6"-8" long, slightly margined. Peduncle short, bibracteolate; the 1-flowered pedicels 3"-4" long, bibracteolate. Calyx 3" long. Petals orbicular? glabrous (in the still closed bud). Ovary glabrous. — The species only known by a single immature specimen.

"Mountains of Kauai."

4. *M. ELLIPTICA* Gray. (*Enum. No. 78.*) Glabrous. Leaves elliptical, obtuse at both ends, thin-coriaceous, the margins revolute, 3'-3 $\frac{1}{4}$ ' long, 1 $\frac{1}{4}$ '-2' wide, not strongly reticulated. Petioles 4"-10" long, slightly margined. Peduncles about the length of the petioles, loosely

cymosely few-flowered. Calyx tomentulose, sepals broadly ovate, acute, 1" long, $\frac{1}{2}$ as long as the ovate tomentulose petals. Follicles ovoid, cinereous-tomentose, 5" long, turgid, coriaceous, 2-valved. Seeds 1 or 2.

Kaala Mountains, in Waianae, Oahu. Woods above Makawao, East Maui.

3. PLATYDESMA H. Mann.

Flowers hermaphrodite. Sepals 4, distinct, persistent, strongly imbricated, rotund, the larger exterior ones including the others in the bud. Petals 4, in æstivation broadly convolute-imbricate or convolute, large and obovate, with recurved apices. Disk plane, slightly 4-lobed. Stamens 8, inserted on the disk, monadelphous below the middle; filaments naked, ovate-lanceolate, thick: anthers sagittate, adnate to the interior face of the filaments. Ovary 4-parted; style central; stigma 4-lobed. Ovules 5 in each cell, amphitropous. Cocci erect, entirely distinct, or only united by the central style, cartilaginous, by abortion usually 2-seeded. — A small tree, with a heavy odor when bruised. Leaves opposite, simple, lanceolate or obovate-lanceolate, obtuse or acuminate, petioled. Cymes axillary, few-flowered: pedicels bibracteolate. Flowers large, white.

(Genus of one species, peculiar to the Hawaiian Islands.)

1. *P. CAMPANULATA* H. Mann. (*Enum. No. 79.*) Leaves 3'-14' long, 1'-5' wide, coriaceous, pinnately-veined, not strongly reticulated. Peduncles and petioles $\frac{1}{2}$ '-2' long. Sepals 4"-5" long. Petals 8"-9" long. Capsule $\frac{1}{2}$ ' in diameter, enclosed by the persistent cup-shaped calyx.

Mountains behind Honolulu, at middle heights.

4. ZANTHOXYLUM Colden.

Flowers polygamous. Calyx 3-5 cleft, imbricated, rarely obsolete. Petals 2-5, rarely none, imbricated or valvate. Male flowers: Disk inconspicuous. Stamens 3-5, hypogynous. Ovary more or less rudimentary. Female flowers: Stamens none, or mere scales. Disk very short. Carpels 1-5, oblique, 1-celled; styles somewhat eccentrical, short or elongated, free or connate above: stigmas capitate. Ovules 2 in each cell. Cocci 1-5, dry or drupaceous, obovoid, usually 2-valved, 1-seeded, the endocarp separating or adnate. Seeds much as in *Pelea*, black and shining. Embryo in the axis of fleshy albumen, straight or curved; cotyledons plane and foliaceous; radicle very short. — Trees or shrubs, unarmed or armed with recurved prickles. Leaves alternate, usually impari-pinnate, rarely 1-3-foliolate. Cyme usually paniculate, axillary or terminal, sometimes crowded.

A considerable genus, throughout the tropical and hot regions of the globe.

COMMUNICATIONS ESSEX INST., VOL. V. 23 OCT., 1867.

1. *Z. KAVAIENSE* Gray. (*Enum. No. 80.*) A small, glabrous, and unarmed tree. Leaves alternate, 3-5-foliate; leaflets membranaceous when young, becoming coriaceous, ovate, acute, $1\frac{1}{2}$ ' long, 1' wide, the lateral ones often somewhat unequal. Panicles solitary or fascicled in the axils, shorter than the leaves, loosely few-flowered. Calyx four-lobed; the lobes ovate-subulate, $\frac{1}{4}$ " long. Petals in the sterile flowers 2" long. Stamens four, 1" long. In the female flowers the petals are linear-ligulate, about 3" long, and imbricated in aestivation; the stamens are reduced to 4 glands. Ovary one-celled, stipitate; stigma globular. Fruit raised on stipes 2" long; the follicles short and turgid, $4''-5''$ long, somewhat wrinkled and punctate, two-valved from the apex, glabrous. Seed solitary, filling the cell, oval, black, and shining.

Kauai, on the mountains above Waimea. Hawaii.

2. *Z. MAVIENSE* H. Mann. (*Enum. No. 81.*) Apparently an unarmed tree; the young branches, petioles, &c., cinereous with a fine velutinous pubescence. Leaves 3-foliate, about 2' long, by $1\frac{1}{4}$ ' wide, the lateral ones very unequal, ovate, obtusish, truncate at the base, puberulent above, quite tomentose beneath. Petioles 15"-20" long. Panicle several-flowered. Flowers unknown. Carpels solitary, sessile, $4''-5''$ long, lunulate-ovoid, becoming 2-valved, dotted externally. Seed solitary, filling the cell.

"Maul."

3. *Z. (BLACKBURNIA) DIPETALUM* H. Mann. (*Enum. No. 82.*) A small tree, entirely glabrous. Leaves alternate, 3-7-foliate, petioled. Leaflets 2'-3' long, 7"-20" wide, oblong or oblong-ovate, obtuse, coriaceous, pinnately veined, equal at the base, and with one or two small (3"-9" long) foliar bodies arising from just below the lower leaflets, which were it not for their anomalous position might be likened to large stipules (are these, however, normal?). Panicles axillary or terminal, cymosely many-flowered, with a very thick and nodose peduncle and axis. Calyx small, less than 1" long, four-lobed. Petals 2, oval, valvate, and remarkably thick, in the bud 3"-4" long, probably caducous. Stamens four; filaments short, subulate; anthers oblong. Only buds of sterile flowers seen, therefore fruit, &c., unknown.

To the tropical Order MELIACEÆ (which are trees or shrubs with alternate, usually compound leaves, destitute of stipules: a calyx of 3-5 sepals, the same number of petals, and twice as many monadelphous stamens, inserted with the petals on the outside of an hypogynous disk: a several-celled ovary, with one or two ovules in each cell, and the styles and stigmas united into one: the fruit a drupe, berry, or capsule, with one-seeded

cells, and the wingless seeds without albumen), belongs the Pride of India tree (*Melia Azederach*) much planted for ornament and use.

ORDER XIX. ILCINEÆ.

Trees or shrubs, with alternate, dotless, coriaceous leaves, and small axillary polygamous flowers. Calyx of 4-6 sepals. Petals 4-9, with as many or twice as many stamens inserted on their bases, which are somewhat united in a ring. Ovary 2-6-celled; the cells with a single suspended ovule. Fruit drupaceous, with as many hard one-seeded pyrenæ (nutlets) as cells to the ovary, or fewer by abortion. Embryo minute, in hard albumen.

1. BYRONIA Endl.

Calyx small, 3-4-lobed. Corolla 5-9-parted. Stamens of the same number or twice as many; filaments subulate; anthers oblong. Ovary globose, 10-18-celled; stigma sessile and discoid. — Leaves glabrous and shining. Cyme trichotomous.

A genus of three species, one each from Australia, Tahiti, and the Hawaiian Islands.

1. *B. SANDWICENSIS* Endl. (*Enum. No. 83.*) A much branched small tree or large shrub, 15°-25° high. Leaves oval or elliptical, obtuse, tapering slightly towards the base, 2½'-4' long, about 2' wide, reticulate-veiny, entire or occasionally serrulate. Petioles 6"-15" long. Flowers in (often many-flowered) cymes. Peduncle 1'-2' long. Pedicels 2"-4" long. Calyx persistent, 4-lobed, about 1" long; the lobes broad, crenulately toothed in fertile flowers. Corolla rotate-spreading, the lobes rounded, 1½"-2" long, white. Stamens short. Ovary sessile, in the sterile flowers small and imperfect. Stigma radiate with 12-18 lines. Drupe black, 3"-4" in diameter.

In mountain woods, at medium elevations, common.

ORDER XX. CELASTRACEÆ.

Shrubs or trees, with simple leaves. Calyx of 4-5 sepals, imbricated in aestivation. Petals as many as the sepals, inserted under the flat expanded disk which closely surrounds the ovary, and mostly imbricated in aestivation. Stamens as many as the petals, and alternate with them, inserted on the margin or upper surface of the disk. Ovary free from the calyx. Fruit a capsule or berry, with one or few seeds in each cell. Seeds usually arilled, albuminous, with a large and straight embryo.

1. **PERROTTETIA** HBK.

Flowers polygamo-diœcious. Calyx 5-parted. Petals 5, triangular-ovate, short, valvate or with the margins imbricated. Stamens in the sterile flowers longer than the petals. Ovary free, 2-celled; style short or elongated; stigma bifid. Ovules 2 in each cell, erect. Berry small, depressed-globular, 2-celled, 2-4-seeded. Seeds exarillate, obovoid, the testa horny and many-ribbed. Embryo very small, in the base of fleshy albumen. — Unarmed shrubs, or small trees. Leaves alternate, petiolate, glandular-serrate. Stipules deciduous. The thyrsoïd panicles axillary.

A genus of four species, from New Grenada, Mexico, and the Hawaiian Islands.

1. *P. SANDWICENSIS* Gray. (*Enum. No. 84.*) A small tree 20° high, more or less; the younger branchlets and lower surface of the unfolding leaves more or less pubescent; otherwise nearly glabrous. Leaves ovate-oblong, abruptly acuminate, pale beneath, $2\frac{1}{2}' - 3\frac{1}{2}'$ long, on petioles $\frac{1}{2}' - 1'$ long. Flowers ($1\frac{1}{2}''$ in diam.) greenish, pedicellate, very numerous, in panicles mostly shorter than the leaves, on a puberulent peduncle. Calyx-lobes ovate-lanceolate, acute, slightly puberulent. Petals scarcely exceeding the calyx, their thin margins ciliate. Stamens 5. Ovary in the male flowers abortive.

Mountains behind Honolulu, on the edge of the woods usually. West Maui, Hawaii, and Kauai: not uncommon.

ORDER XXI. RHAMNACEÆ.

Shrubs or trees, with usually alternate simple leaves, and small flowers. Calyx of four or five sepals, united at the base, valvate in æstivation. Petals four or five, cucullate or convolute, inserted on the throat of the calyx. Stamens as many as the petals, inserted with and opposite them. Ovary sometimes coherent with the tube of the calyx, and more or less immersed in a fleshy disk, with a single erect ovule in each cell. Seeds sometimes arilled. Embryo straight, large, in sparing albumen. — Jujube paste is prepared from the berries of *Zizyphus Jujuba* and *Z. vulgaris* of Asia. *Z. Lotus* is the Lote-bush which gave name to the ancient Lotophagi.

Flowers hermaphrodite. Base of calyx-lobes surrounding the fruit as a ring (i. e., the ovary only partly inferior), not winged or ribbed.

Drupe with a hard cartilaginous exocarp. Leaves mostly or entirely smooth, 1. COLUBRINA.

Drupe with a dry, mealy, or corky exocarp. Leaves and cymes more or less rusty downy, 2. ALPHITONIA.

Flowers polygamous. Fruit crowned by the persistent calyx (i. e., ovary entirely inferior), winged or ribbed, 3. GOCANIA.

1. COLUBRINA L. C. Rich. [Kukuku.]

Flowers hermaphrodite. Calyx 5-parted, tube hemispherical, lobes triangular-ovate, spreading. Petals 5, inserted on the margin of the disk, unguiculate, hooded. Stamens 5, included in the petals. Disk thick, filling the calyx-tube, annular, 5-10-lobed. Ovary immersed in the disk, 3-celled, terminated by a 3-parted style; stigmas obtuse, papulose. Drupe obscurely 3-lobed, ringed below the middle by the calyx-tube, 3-celled, loculicidally dehiscent or 2-valved. Seeds 3-sided. Albumen thin. Cotyledons orbicular. — Erect or spreading shrubs. Leaves alternate or opposite, usually 3-nerved from the base. Flowers axillary, cymose or fascicled.

Genus of about 10 species, mostly from tropical and warm North America, one widely spread throughout the old world.

1. *C. ASIATICA* Brongn. (*Enum. No. 85.*) A large shrub, quite glabrous, with long, slender, often flexuose branches. Leaves petiolate, ovate or broadly cordate, acuminate, 2' - 3' long, crenate-serrate, 3-nerved and penninerved, smooth and shining but scarcely coriaceous. Cymes shortly pedunculate, rarely exceeding the petioles. Flowers greenish, about 2" in diameter. Fruit about 4" in diameter, depressed at the top, furrowed opposite the dissepiments, the endocarp separating more or less perfectly into 3 or rarely 4 membranaceous cocci.

In open land, as in the vicinity of Ewa, &c., Oahu. Also Kauai, and probably the other islands. A common species throughout the Pacific and tropical Asia.

2. *C. OPPOSITIFOLIA* Brongn. (*Enum. No. 86.*) At once to be distinguished from No. 1, by its opposite, entire, coriaceous, ovate or oblong leaves. Plant smooth throughout, with more rigid branches than *C. Asiatica*. Leaves 2½' - 5' long, 1' - 3' wide. Fruit harder and larger.

Hawaiian Islands (collected by Remy), no localities specified.

2. ALPHITONIA Reissek. [Kauwila.]

Flowers hermaphrodite. Calyx 5-lobed, spreading, with a strong salient crest on the inside of the lobes. Petals involute. Stamens 5, included in the petals. Disk thick, filling the calyx-tube. Ovary immersed in the disk, 2- or rarely 3-celled, tapering into a shortly-lobed style. Drupe globular or broadly ovoid, the epicarp of a dry, mealy, or somewhat corky substance; endocarp of 2 or 3 hard coriaceous nuts or cocci, opening inwards by a longitudinal slit. Seeds with a shining hard testa, completely enclosed in a membranous brown shining arillus, open at the top, but with the edges folded over. Albumen cartilaginous or horny; cotyledons flat. — Tree. Leaves alternate, penni-

nerved. Cymes dichotomous, many-flowered. Seeds often persisting on the torus after the pericarp has fallen off.

Genus probably limited to one very variable species, ranging from Australia throughout most of the Pacific.

1. *A. EXCELSA* Reissek. (*Enum. No. 87.*) A tall hard-wooded timber-tree, the young branches, petioles, and inflorescence hoary or rusty with a close tomentum, sometimes nearly glabrous. Leaves petiolate, varying from broadly ovate or almost orbicular and very obtuse, to ovate or ovate-lanceolate and acute or acuminate, usually 3'-6' long, entire, coriaceous, glabrous or slightly hoary above, white or rusty-colored beneath with a close tomentum, the parallel pinnate veins very prominent. Flowers 2"-3" in diameter, in little umbel-like cymes, arranged in dichotomous cymes in the upper axils or in a terminal corymbose panicle. Calyx tomentose, often very much so, and rusty. Disk broad and nearly flat. Fruit 3"-4" in diameter, or sometimes larger.

Mountains above Waimea, Kauai, where it attains a size of nearly 100 ft. high and 2 ft. in diameter at base. Maui, Lanai, and probably Hawaii also. Perhaps on Waialea Mountains, Oahu. A large and valuable timber-tree of which the natives manufacture their kapa mallets, their spears, &c. Ranges through the Pacific into Australia.

3. *GOUANIA* Jacq.

Flowers polygamous. Calyx-tube short, cohering with the ovary, 5-lobed. Petals 5, inserted on the margin of the disk, hooded. Stamens 5, included in the petals. Disk glabrous or pilose, filling the calyx tube, 5-angled or produced into 5 horns. Ovary immersed, 3-celled. Style 3-parted: stigmas minute. Fruit coriaceous, inferior, being crowned by the persistent calyx, 3-winged: cocci somewhat woody, indehiscent, and separating from the axis. Seeds plano-convex, obovate, testa horny and shining; albumen scanty. Cotyledons round.—Shrubs, often climbing and tendrils bearing, glabrous or tomentose. Leaves alternate, petioled, entire or dentate, penninerved or 3-nerved. Stipules oblong, deciduous. Flowers small, in terminal or axillary spikes or racemes; the rachis often transformed into a tendril.

A genus of 40 species, mostly in Central America and West Indies, a few African and Asiatic, and a few in the Pacific, none in Australia.

1. *G. VITIFOLIA* Gray. (*Enum. No. 88.*) A shrubby glabrous plant, climbing by tendrils. Leaves membranaceous, about 2' long by nearly as wide, glabrous, or with a soft pubescence beneath, crenate-toothed. Flower-spikes short or about equalling the leaves in length, dense, especially towards the upper part which bears the sterile

flowers. Fruit when ripe moderately 3-winged or angled, about 5" in diameter.

Dry hills, district of Waianae, Oahu.

2. *G. ORBICULARIS* Walp. (*Enum. No. 89.*) An upright or decumbent shrub at once distinguished from No. 1, by having no tendrils, by the rather thickish oval or orbicular, obtuse or even retuse, short petioled leaves which are entire, or nearly so, and by the younger branches, leaves, &c., being silky pubescent. The small axillary cymes scarcely longer than the petiole. Fruit much as in the last but scarcely as large. A *Var.* has the petioles longer than the leaves and the peduncles of the cymes equalling them, and broader wings to the fruit.

Sandy isthmus of Maui. Lanai. The *Var.* from Hawaii.

ORDER XXII. SAPINDACEÆ.

Trees, shrubs, or climbers with tendrils (rarely herbs), with simple or compound leaves; the sepals and petals imbricated in aestivation. Stamens 5-10, inserted on a fleshy perigynous or hypogynous disk. Ovary 2-6-celled, and lobed, with one or two ovules in each cell; the embryo curved or convolute and without albumen.

1. *DODONÆA* Linn. [*Alii.*]

Flowers polygamous or unisexual, often diœcious. Sepals 5 or fewer, valvate in the bud. Petals none. Disk small. Stamens usually 8, sometimes fewer, rarely 10; filaments very short. Ovary 3-4-, rarely 5-6-celled, with two ovules in each cell: style short, or in some flowers very long, lobed at the end. Capsule membranaceous or coriaceous, opening septicidally in as many valves as cells, each valve with the dorsal angle often produced into a vertical wing, and in falling off leaving the dissepiment attached to the persistent axis, or rarely the dissepiments splitting and remaining attached to the valves, thus closing the carpels and leaving only the central filiform axis persistent. Seeds 1-2, with a thickened stalk, but not arillate; testa crustaceous; embryo spirally curled. — Shrubs, often arborescent; the young shoots usually viscid. Leaves simple, or pinnate with small leaflets, with or without a terminal odd one. Flowers small, axillary or terminal, solitary, clustered, or in short racemes or panicles.

With the exception of the Hawaiian species, the first of which is widely dispersed over almost all hot countries, one from South Africa, and one or two from Mexico, the species of the genus to the number of about 40 are all endemic in Australia.

1. *D. VISCOSA* Linn. (*Enum. No. 90.*) A shrub 2°-25° high, glabrous, and more or less viscid, the young branches frequently com-

pressed or somewhat triangular. Leaves simple, varying from broadly oblong-lanceolate, acute or acuminate, and 3'-4' long, to narrow-lanceolate, or oblong-cuneate and very obtuse, or almost linear-cuneate, always narrowed into a more or less distinct petiole, entire or obscurely sinuate, or rarely almost 3-toothed at the end, the pinnate veins usually rather numerous and very divergent, sometimes scarcely conspicuous. Sepals ovate, usually as long as, or rather longer than, the oblong obtuse anthers. Style rarely elongated. Capsule very variable in size, the wings continued from the base to the style, or nearly so. Seeds rather large, dark-colored, opaque or scarcely shining. Var. *SPATHULATA*: usually a small and low bush, often very viscid. Leaves shorter, obovate-oblong, oblong-cuneate, spatulate, oblanceolate or broadly linear-cuneate, often obtuse or truncate.

Not uncommon in open land on the sides of mountains. Also Waialua Valley, West Maui. The variety in the high regions of Hawaii and East Maui.

2. *D. ERIOCARPA* Smith. (*Enum. No. 91.*) Agreeing with No. 1 in most points, but with the leaves generally duller, and the young branches, petioles, the capsules and margins and midribs of the leaves puberulent with short scattered hairs. Perhaps not sufficiently distinct from *D. viscosa*.

In much the same places as the last species, usually in dry situations.

2. *CARDIOSPERMUM* Linn. [Poniu.]

Flowers polygamous, Sepals 4, broadly imbricate, the two outer ones small. Petals 4, 2 larger with a large scale, 2 smaller with a crested scale. Disk one-sided, almost reduced to 2 prominent glands opposite the lower petals. Stamens 8, oblique. Ovary eccentric, 3-celled, with one ovule in each cell; style very short, with 3 stigmatic lobes. Capsule inflated, membranous, more or less 3-cornered, 3-celled, opening loculicidally. Seeds globose, with a thick stalk and small arillus; testa crustaceous; cotyledons large, transversely folded. — Herbs or undershrubs, mostly climbing. Leaves dissected. Flowers few, small, on long axillary peduncles, which usually bear a tendril under the panicle.

A small genus, chiefly American, of which 2 species are also spread over the old world within the tropics, and a third is perhaps confined to the old world. The Hawaiian species is one of those most widely diffused.

1. *C. HALICACABUM* Linn. (*Enum. No. 92.*) A straggling, or somewhat climbing annual or perhaps perennial, attaining several feet in length, glabrous, or slightly pubescent. Leaf-segments usually twice ternate, ovate or ovate-lanceolate, coarsely toothed or lobed, the upper leaves smaller, narrower, and less divided. Peduncles 2'-3' long, bearing a double or treble short recurved tendril, under the small

panicle, which is often reduced to an umbel of few small white flowers. Capsule flat on the top, usually pubescent.

Scattered more or less abundantly in various parts, trailing over shrubs, or scrambling among the herbage. A common weed in most tropical regions. The Hawaiian form belongs to the variety with fruits scarcely 3-4' in diameter, often considered as a distinct species (*C. microcarpum* HBK.). It is as frequent and widely spread as the form with fruits more than 1' in diameter.

ORDER XXIII. ANACARDIACEÆ.

Trees or shrubs, with a resinous or milky, often acrid juice, which turns blackish in drying; the leaves alternate, without stipules, and not dotted. Flowers small, often polygamous or diœcious. Calyx of 3-5 sepals, inserted on the base of the calyx, or on an hypogynous disk. Ovary one-celled, but with three styles or stigmas; ovule solitary. Fruit a drupe. Seed without albumen. Embryo curved or bent. — Many species contain a caustic poison juice, but ours is innocuous. To this order belong the Mango (*Mangifera Indica*), the Pistachio-nut (*Pistacia vera*), and the Vi (*Spondias dulcis*) of the Southern Pacific Islands; also other edible and useful fruits.

1. RHUS Linn.

Sepals, petals, and stamens, 5. Ovary 1-celled, with 3 short styles or stigmas. Ovule 1, suspended from an erect filiform funiculus. Drupe small, oblique, often nearly dry. Radicle short, curved against the edge of the flat cotyledons. — Trees or shrubs. Leaves pinnate, or sometimes simple.

A large genus, widely distributed over the temperate and tropical parts of the globe, a large proportion at the Cape of Good Hope.

1. *R. SEMIALATUM* Murray. (*Enum. No. 93.*) A shrub or tree, 4°-40° high, the stout branches warty, smooth, or, when developing velvety-tomentose, as are the petioles, inflorescence, &c. Leaves pinnately 5-13-folliolate, or the upper ones sometimes trifolliolate. Leaflets oval or oblong, obtuse or acuminate, 2'-6' long, 1'-4' wide, serrate, almost sessile, downy beneath, glabrous above. Panicle terminal, very large and compound, 6'-12' long (sometimes smaller ones in the upper axils). Flowers small, 1½'' in diameter, yellowish. calyx nearly glabrous, deeply 5-cleft; the lobes oblong-ovate, minutely ciliate, not half the length of the oval and minutely ciliate petals. Stamens rather shorter than the petals. Fruit 2'' in diam., glabrate. — *R. Sandwicensis* Gray.

Mountains of Oahu; West Maui; near Hilo, Hawaii.

ORDER XXIV. LEGUMINOSEÆ.

Herbs, shrubs, or trees, with alternate and usually compound leaves, with stipules. Calyx of (4 or) 5 sepals, more or less united, the odd sepal inferior. Corolla of 5 petals, either papilionaceous or regular. Stamens perigynous or hypogynous. Ovary single and simple. Fruit a legume, which takes various forms. Seed nearly or usually quite destitute of albumen. — An immense order, yielding many products of great value to man; and botanically divided into three suborders:—

PAPILIONACEÆ, which is characterized by the papilionaceous corolla, — the vexillum or superior petal always external in æstivation, — ten diadelphous, monadelphous, or rarely distinct perigynous stamens, and the radicle bent on the large cotyledons. Leaves (rarely simple) only once pinnately compound. — Familiarly represented by the Pea (*Lathyrus Pisum*), and Bean (*Phaseolus lunatus*).

CÆSALPINEÆ, in which the corolla is less distinctly papilionaceous, and the vexillum is covered by the lateral petals in æstivation; the stamens are distinct, and the embryo straight. The leaves are often bipinnate. — To this suborder belongs the Tamarind (*Tamarindus Indicus*), which represents it well.

MIMOSÆ (represented with us only by the Sensitive Plant and the *Acacia*) has a perfectly regular calyx and corolla, the latter mostly valvate in æstivation and hypogynous, as well as the stamens, which are sometimes definite but often very numerous. The leaves are frequently bi-tripinnate.

SUBORDER I. Papilionaceæ. — Corolla papilionaceous, the upper petal (vexillum or standard), outside in the bud.

Leaves simple or of three digitate leaflets. Stamens monadelphous. 1. **CROTALARIA.**

Leaves of 3 pinnately arranged leaflets, i. e. the two lateral inserted below the terminal one. Stamens diadelphous (9 & 1), rarely monadelphous.

Tree, with wings and keel of the flower very small, standard large, 7. **ERYTHRINA.**

Twining or sometimes trailing woody vines, with large flowers.

Standard and keel long and narrow, wings short,

Standard broad and shorter than the rest of the petals; keel

acute,

Standard very broad, as long as the other petals,

Twining or sometimes trailing herbs; pod not jointed.

Keel spirally twisted or coiled, 12. **PHASEOLUS.**

Keel incurved, often pointed.

Wings nearly free; stigma lateral, 13. **VIGNA.**

Wings adherent to the keel; stigma terminal, 14. **DOLICHOS.**

Wings free; stigma terminal; calyx very unequal, 11. **CANAVALLIA.**

Erect or spreading herbs, or woody at base.

Pod sometimes jointed.

Pod not jointed, 15. **CAJANUS.**

Pod jointed, joints easily separating, 8. **DREMODIUM.**

Leaves of 5 or more pinnately arranged leaflets.

Stamens monadelphous or diadelphous.

Under shrubs or herbs, not twining or climbing.

Pod not especially elongated.

Stamens diadelphous; pod nearly terete, or tetragonal, 2. INDIGOFERA.

Stamens partially monadelphous; pod flattened, 3. TEPHROSIA.

Pod elongated (8' - 18' long), 4. SESBANIA.

Herbs climbing by tendrils at the ends of the leaves, 6. VICIA.

Stamens all free (*Sophoræ*), 16. SOPHORA.

SUBORDER II. *Cæsalpinieæ*. Corolla irregular or nearly regular, imbricate in the bud, the upper petal inside.

Leaves twice pinnate. Pod prickly or not, 17. CÆSALPINIA.

Leaves once pinnate, 18. CASSIA.

SUBORDER III. *Mimoseæ*. Corolla regular. Petals small, valvate in the bud. Leaves twice pinnate.

Stamens free and definite. Pod prickly, 19. MIMOSA.

Stamens free and indefinite. Pod smooth, 20. ACACIA.

TRIBE I. GENISTEÆ.

Leaves simple, or of 3 (rarely 5) digitate leaflets, all inserted at the end of the petiole. Racemes terminal or leaf-opposed. Stamens all united in a tube.

1. CROTALARIA Linn.

Calyx 5-cleft. Standard broad. Wings free, transversely wrinkled above the claw. Keel with a straight or curved point or beak. Stamens all united in a sheath, open on the upper side. Anthers alternately ovoid and oblong. Style suddenly bent in above the ovary. Pod inflated. — Herbs or shrubs. Leaves simple and subsessile, or with 3 - 5 digitate leaflets at the end of the petiole. Stipules very small. Pedicels solitary to each bract, with bractlets close under or even upon the calyx. Flowers yellow, or rarely bluish or purplish.

A large, chiefly tropical genus, with a few extratropical species in North America, South Africa, and Australia.

Leaves simple.

Raceme without large bracts. Leaves evenly tapering at both ends, 1. *C. Assamica*.

Raceme with large ovate acuminate bracts. Leaves oblanceolate,

blunt, mucronulate, 2. *C. sericea*.

Leaves trifoliate, 3. *C. longirostrata*.

1. *C. ASSAMICA* Benth. (*Enum. No. 95.*) An erect shrub, 6° - 10° high, with herbaceous branchlets. Leaves elongate-lanceolate, tapering at both ends, glabrous above, sericeous below with soft, somewhat fulvous hairs, as also the branches and calyxes, 4' - 6' long, 1' or more wide, very short petioled. Racemes long and terminal, many-flowered. Bracts subulate-lanceolate, 2'' long. Bractlets about the middle of the short pedicel. Calyx-lobes 4'' - 5'' long, but the lower three joined two-thirds of the way up. Flowers $\frac{3}{4}$ ' long, yellow, a

longitudinal line of fine hairs on the back of the standard. Pod glabrate.

Known only from Assam, elsewhere! introduced into the Hawaiian Islands.

2. *C. SERICEA* Retz. (Enum. No. 96.) Stem erect, 3° – 8° high, obtuse-angled, glabrous; leaves oblanceolate, blunt, mucronulate, tapering at base into a short petiole, glabrous above, subsericeous pubescent beneath, pellucid-dotted, 2'–5' long, $\frac{1}{2}$ '–2 $\frac{1}{2}$ ' wide. Stipules sessile, semisagittate, somewhat reflexed. Racemes terminal, elongated, many-flowered, each pedicel from the axil of a large ovate acuminate bract. Calyx bilabiate, $\frac{1}{2}$ ' long, about half the length of the yellow corolla, the superior lobes ovate, inferior ovate-lanceolate. Pod oblong, much inflated, shortly and broadly stipitate, glabrous.

Not uncommonly planted around native houses as a hedge; doubtless introduced. Native of the East Indies, and naturalized in the West Indies.

3. *C. LONGIROSTRATA* Hook. & Arn. (Enum. No. 97.) Suffrutescent, 2° – 3° high, branched, minutely pubescent with fine hairs. Leaves long-petioled; leaflets 3, obovate or oblong, obtuse or slightly retuse, mucronulate, tapering to a somewhat cuneate base, terminal one 1' or more long, the lateral ones smaller. Stipules, and also bracts, very small, scarce 1" long, subulate, pubescent, deciduous. Racemes terminal, becoming lateral by the evolution of the stem, many-flowered. Flowers large, yellow. Pedicels 2"–3" long, recurved in fruit. Keel with a long straight beak, 7" long, exceeding the other petals. Calyx 5-lobed, the two upper lobes ovate-lanceolate, the others linear-lanceolate, all slightly pubescent. Pod oblong, 6"–9" long, on a stipe which is shorter than the calyx, minutely pubescent. Ovules about 10, seeds 4–6.

In waste places, road-sides, etc., near Honolulu. Doubtless introduced. Native of the region about Acapulco, Mexico.

TRIBE II. INDIGOFERÆ.

A small tribe, almost limited to the genus *Indigofera*, distinguished chiefly by the anthers, tipped with a gland or point, from *Galega*, with which they would be united, but that the leaflets are in a few species digitate, as in *Gentiana*.

2. INDIGOFERA Linn.

Calyx small, broadly and obliquely campanulate, with 5 teeth or lobes, the lowest the longest. Standard ovate or orbicular. Keel erect, with long claws, and a small protuberance or spur on each side above the claw. Stamens diadelphous, the sheath slender, and usually persistent after the fall of the petals. Anthers tipped with a small gland or point. Ovary sessile or nearly so, with several ovules. Pod usually slender, cylindrical or 4-angled, with transverse cellular partitions between the seeds, rarely flattened, or when reduced to a single

seed nearly globular. — Herbs, undershrubs, or slender shrubs, more or less hoary, or sprinkled with appressed hairs, fixed by their centre. Leaves usually pinnate, with opposite or alternate leaflets and a terminal odd one, sometimes reduced to 3 or 1, and in a few African species with 3-5 digitate leaflets. Stipules small; stipellæ occur occasionally. Flowers usually red or purple, in axillary spikes or racemes.

A large genus, widely spread over tropical Asia and America, but still more abundant in tropical and Southern Africa, with a few Australian species.

1. *I. ANIL* Linn. (*Enum. No. 98.*) A shrub, 3°-5° high, more or less hoary, with appressed hairs. Leaflets in the more luxuriant specimens of 8-9 pairs, besides the terminal one, and fully 1' long, in drier situations often 2-4 pairs, and not above 6" long, all opposite, from obovate to oblong, glabrous or nearly so on the upper side, hoary beneath. Flowers scarcely above 2" long, on very short recurved pedicels, in short, dense, almost sessile racemes. Calyx campanulate, with short, broad teeth. Pods about $\frac{1}{4}$ ' long, usually many together and much incurved, slightly 4-edged, with 6-10 seeds.

A very common weed, though introduced but a few years since. It is supposed to be of American origin, but has been so much cultivated for Indigo, that it is diffused throughout the tropics, and it is difficult to fix its native country.

TRIBE III. GALEGÆÆ.

Herbs, not twining, or shrubs, trees, or woody climbers. Leaves pinnate, often stipellate. Racemes axillary or terminal. Stamens monadelphous or diadelphous, the anthers obtuse. Ovary with 2 or more ovules. Pod opening in 2 valves.

3. *TEPHROSIA* Pers. [Auhuhu.]

Calyx 5-toothed. Standard broad, as long as or longer than the obtuse keel. Upper stamen free at the very base, but adhering to the sheath of the others in the middle. Style curved, glabrous, excepting sometimes a tuft of hairs on the terminal stigma. Pod linear, compressed, 2-valved, without partitions between the seeds. — Herbs, undershrubs, or rarely shrubs. Leaves pinnate, with several pairs of opposite leaflets, and a terminal odd one, or very rarely reduced to a single leaflet; the veins of the leaflets numerous, parallel and oblique. Racemes terminal, leaf-opposed or in the upper axils, often leafy at the base. Flowers 2 to 6 together at each bract.

A considerable genus, widely spread over the tropical regions of the globe.

1. *T. PISCATORIA* Pers. (*Enum. No. 99.*) Stock perennial and often woody, with slender but stiff decumbent, ascending, or even erect stems, 1°-2° high, with spreading branches; the younger shoots often silky-hoary, becoming at length nearly glabrous. Leaflets in several rather distant pairs, cuneate oblong or linear, about $\frac{1}{4}$ ' long.

Racemes terminal or leaf-opposed, the lower ones often very short, the upper ones 6' or more long, with distant fascicles of 3-4 usually white flowers, each about 4'' long; the broad standard scarcely exceeding the fine subulate calyx-teeth. Pod rather more than 1' long, glabrous or nearly so, with 6-8 seeds.

Common on or near the coast, and sometimes found more inland. Common throughout the Pacific, and tropical Asia. Called "Anhola" or "Hola" when pounded up for use in poisoning or intoxicating fish.

4. *SESBANIA* Pers. [Ohai.]

Calyx truncate or 5-toothed. Standard roundish, patent or reflexed. Wings falcate-oblong. Keel incurved. Stamens diadelphous, the one next the standard free. Legume linear, subsessile or stipitate, impressed along both margins, many-seeded, tardily dehiscent; seeds separated by spurious dissepiments. — Sometimes tree-like shrubs. Leaves abruptly pinnate, with many pairs of leaflets. Stipules caducous. Racemes axillary. Flowers yellow, purple, or white, showy. Bracts and bractlets caducous.

A small genus, but widely dispersed throughout the tropics.

1. *S. (AGATI) TOMENTOSA* Hook. & Arn. (*Enum. No. 100.*) A woody plant, with decumbent stems 15°-20° in length; the branches, foliage, &c., silky-tomentose when young, but glabrate with age. Leaves 4'-7' long, very short petioled; leaflets 8-12 pairs, oblong-elliptical, 7''-14'' long, 3''-4'' wide, pale. Stipules minute. Calyx cyathiform, about 4'' long, with broad acute teeth. Petals 1' or more long, red or yellow, brightly colored. Pod nearly terete when mature (compressed when young) 5'-7' long, 1½''-2'' wide, constricted at intervals, slightly stipitate. Seeds 8-20, shining.

HAB. Waianae, Oahu, and perhaps in other parts. Puna, Hawaii. Niham.

2. *S. (AGATI) GRANDIFLORA* Poir. (*Enum. No. 101.*) A tall shrub, 10°-20° high, of very slender growth; nearly glabrous. Leaves 5'-7' long, very short petioled; leaflets 10-20 pairs, oblong, obtuse, 5''-15'' long, 3''-4'' wide, pale, smooth. Stipules minute. Calyx deeply cyathiform, as long as broad, 7''-8'' long, truncate or having short teeth. Petals 2½'-8' long, very brilliantly variegated. Pod nearly terete, 12'-18' long, 2'' wide, torulose, at length 2-valved, tipped by the long style. Seeds 30-50, rather dull. — *S. coccinea*, Poir.

Waimea, Kauai, in swamps, and doubtless in many other places, but apparently becoming killed out. Probably introduced. A native of the East Indies, but common now in many tropical countries.

TRIBE IV. *HEDYSAREÆ*.

Herbs, or very rarely shrubs or trees. Leaves various. Pod separating transversely into one-seeded joints, usually indehiscent, or sometimes reduced to a single one-seeded

indehiscent reticulated joint. An artificially distinguished group, having the foliage and other characters sometimes of the *Lotea*, sometimes of the *Galega*, or of the *Phaseolus*.

5. DESMODIUM De Cand.

Calyx campanulate, with 4 acuminate teeth or lobes; the upper one 2-toothed or 2-cleft; or rarely equally 5-cleft. Petals narrow, the standard obovate, the wings usually adhering laterally to the keel, which has often on each side at the point of adhesion a small oblique membranous appendage. Stamens either monadelphous, with the sheath open on the upper side, or the upper stamen more or less free. Ovary sessile or stipitate, with two or more ovules. Style glabrous, with a minute terminal stigma. Pod consisting of two or more flat joints, usually reticulate, and often muricate; the joints mostly indehiscent. — Herbs or shrubs. Leaves with 1-3 leaflets. Flowers usually small, in terminal or leaf-opposed racemes or panicles, or rarely in axillary clusters.

A large genus, widely dispersed over the tropical regions of the New and Old Worlds, with a few species in extratropical N. America, S. America, S. Africa, and Australia.

1. *D. SANDWICKENSE* E. Meyer. (*Enum. No. 102.*) A decumbent or erect perennial, 1°-2° high; branches, peduncles, petioles, &c., pubescent with brownish hairs. Leaves trifoliate, leaflets ovate, obtuse or acute, glabrous above, hirsute beneath, especially on the midrib and veins, 7"-18" long, 3"-10" wide, the terminal one larger than the two lateral ones, and on a short stock. Stipules small, caducous. Racemes 3'-6' long. Flowers 3"-4" long, on slender pedicels, a little shorter than they. Calyx lobes longer than the tube, acute from a broad base. Pod short-stipitate, 5-10-jointed and seeded, 1' long, more or less, 1½" wide. Joints easily separating and adhering to anything rough, as fleece or clothes.

Common everywhere in land not too dry. An important forage plant and generally known as "Spanish Clover," but not a true clover.

2. *D. TRIFLORUM* DC. (*Enum. No. 103.*) Stems slender, much branched, prostrate or creeping, often not above a few inches long, and sometimes spreading to 1° or 2° long. Leaflets 3, broadly obcordate or obovate, 3"-4" or rarely 6" long and broad, glabrous or sprinkled with silky hairs. Flowers pink, scarcely 2" long, on slender pedicels of 2"-6"-8" long, usually 2 together opposite the leaves. Pod sessile, 4"-7" long, slightly curved, pubescent or glabrous, the upper edge continuous, the lower slightly indented, consisting of 3-6 nearly square joints which sometimes separate, but frequently remain attached and open along the outer edge to shed their seed.

Not uncommon in grassy places; probably introduced. Common in tropical Asia and Africa, and in some parts of tropical America.

TRIBE V. VICIÆ.

Low or climbing herbs. Leaves usually abruptly pinnate, the petiole running out into a tendril, rarely imparipinnate or simple. Stipules usually large. Flowers solitary or racemed. Ovules 2-3. Pod 2-valved.

6. VICIA Linn.

Calyx often oblique, teeth nearly equal, or the 2 upper shorter. Standard wide, emarginate. Wings adhering to the keel to their middle, and longer than it. Stamen next the standard free, or more or less united. Ovary nearly sessile or stipitate, 2, or more often, many-ovuled. Style filiform, variously barbed or villous with hairs near the apex, or rarely glabrous. Pod compressed, 2-valved, continuous within. — Usually climbing herbs, rarely low and spreading. Leaves, especially the lower ones, imparipinnate, usually with many leaflets, or in the upper ones the midrib lengthened into a tendril. Flowers either solitary or nearly so, in the axils, or racemed. Bracts very caducons.

A considerable genus, widely diffused, mostly in temperate regions.

1. *V. MENZIESII* Spreng. (Enum. No. 106.) A very large species for the genus, climbing among shrubs; nearly glabrous. Stems angled, minutely pubescent, very leafy. Stipules foliaceous, pectinately dentate with long and subulate teeth, especially the lower ones, which are rounded or flabellate, and $\frac{1}{2}$ ' to 1' in diameter; the upper half sagittate and acuminate. Leaves 6' - 7' long. Leaflets 8 - 12, from $1\frac{1}{2}$ ' - $2\frac{1}{2}$ ' long, $\frac{3}{4}$ ' - 1' wide, ovate-oblong, obtuse, very veiny, mucronulate, commonly alternate; the lowest near the stem. Tendrils much branched, compound. Peduncles shorter than the leaves, 2' - 4' long, 6-9 flowered; the pedicels slender, approximate, 3'' - 5'' long. Flowers very large, 1' - $1\frac{1}{2}$ ' long, pale purple. Calyx-teeth as long as the tube, 3'' long, narrow, very acutely subulate, the lower one a little longer than the others. Standard recurved, ecallose. Style minutely pubescent all round above the middle. Stigma terminal, minute. Pod unknown.

In forests of Mauna Kea, Hawaii.

TRIBE VI. PHASEOLÆ.

Stems usually herbaceous, twining or prostrate, rarely shrubs or trees. The leaves with 3 leaflets rarely (5-7), the two opposite ones inserted below the terminal one, or rarely wanting. Inflorescence usually axillary. Stamens diadelphous, with the upper stamen free at the base, although sometimes united with the others in the middle. Pod 2-valved.

Cliitoria ternatea, a climbing vine, belonging to this tribe, is much cultivated for its fine blue flowers.

7. ERYTHRINA Linn. [Wiliwili.]

Calyx truncate, or more or less 5-toothed. Standard large and

elongated, erect or patent, nearly sessile or long clawed. Wings short, sometimes none. Keel much shorter than the standard, joined on the back or free. Stamens diadelphous, the alternate ones often without anthers. Ovary stipitate, many-ovuled. Legume stipitate, falcate, narrowed at the base and apex, more or less constricted between the seeds, 2-valved. — Shrubs or trees. Stipules small. Leaves pinnately 3-foliolate. Racemes axillary and leafless, or terminal and leafy at the base. Flowers showy, often red. Bracts small.

A small genus, dispersed through hot and tropical regions.

1. *E. MONOSPERMA* Gaud. (*Enum. No. 105.*) Tree with a broad spreading top, about 30° high, aculeate on the young branches with short prickles. Petioles, peduncles, &c., tomentose. Leaves 6'–8' long; leaflets broadly triangular-ovate, truncate at the base, obtuse, 2½'–5' long and about as broad, terminal one much larger than the lateral ones, glabrous above, pubescent beneath. Rachis very stout and woody, 6' long, many- (15–25-) flowered. Flowers red, much the color of red coral, with some yellow, showy. Calyx 3''–4'' long, truncate, or slightly toothed, very tomentose-pubescent. Standard more than an inch long and nearly as broad as long, 3 times longer than the obtuse wings and keel. Stamens nearly as long as the standard, 9 of them united to the middle, the tenth free. Ovary ½' long, half the length of the style, very tomentose. Pod 1½'–4' long, 1 to several-seeded (the name *monosperma* hence badly adapted to the species). Seeds about ½ inch long, bright red.

Dry slopes of West Maui. Kawaihae, Hawaii, and similar places throughout the group. Apparently much less common than formerly.

8. *STRONGYLODON* Vogel.

Calyx teeth broad, obtuse, nearly equal. Standard ovate-oblong, acute, recurved or often reflexed, appendiculate, and with two callosities near the base. Wings much shorter than the standard, adhering to the keel, which is long-beaked and incurved, equalling the standard in length, and its two petals cohering on the back. Stamens diadelphous. Anthers uniform. Ovary stipitate, 1–few-ovuled; style filiform, not bearded. Pod stipitate, obliquely ovate-oblong, 2-valved, the valves convex and coriaceous. Seed large, orbicular. — Climbing vines, woody at the base, and glabrous. Leaves pinnately 3-foliolate. Stipules small. Flowers red, showy, fasciculately-racemed on long axillary peduncles. Bracts quite small.

Genus of 3 species, one in Luzon, one in New Hebrides, and the other in the Viti and Hawaiian Islands.

1. *S. LUCIDUM* Seemann. (*Enum. No. 106.*) A twining vine, with
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slender herbaceous branches, glabrous throughout. Stipules ovate, obtuse, persistent. Leaflets ovate, from roundish to oblong-ovate, more or less acuminate, $2\frac{1}{4}'$ – $5'$ long, membranaceous, triplinerved. Petiolules $3''$ – $4''$ long, exceeding the stipellæ. Racemes axillary, at least twice the length of the leaves, $8'$ – $18'$ long, the rachis with many nodes, each node with about 8 flowers, or sometimes the flowers on the apex of a short peduncle. Bracts very caducous. Pedicels $1'$ or more long, equalling the developed flower in length, with a pair of caducous ovate bractlets immediately under the calyx. Calyx campanulate, $3''$ long, 5-toothed, teeth very broad and obtuse; the two upper ones very nearly united in one. Corolla bright red. The standard thrice the length of the wings, its base appendiculate on each side by a strongly inflexed membrane; the face callose as if by an adherent membrane, which is denticulate at the upper edge, and produced on each side into a free and salient auricle or lamella. Ovary on a stipe at length longer than itself and as long as the calyx, glabrous, compressed, 1- or more frequently 2-ovuled. Style very long and capillary. Stigma terminal, and with minute hairs. Pod $3'$ long, $1\frac{1}{4}'$ wide, on a stipe $1\frac{1}{4}'$ or more long.

Kaala Mountains, and mountains behind Honolulu, Oahu. Forests on the slopes of Mouna Loa, Hawaii. Also Viti Islands.

9. MUCUNA Adanson.

Two upper calyx-teeth wholly connate. Standard shorter than the other petals, appendaged with inflexed auricles at the base. Keel as long or longer than the wings, curved and usually tipped with a cartilaginous beak. Stamens diadelphous. Ovary villous, few-ovuled; style filiform, with a small terminal beak. Pod thick, ovate-oblong or elongated, usually covered with stinging hairs, 2-valved. Seeds with an oblong or linear hilum. — Twiners or tall climbers. Leaflets 3, the stipellæ subulate or sometimes wanting. Racemes on long axillary peduncles. Flowers large, pedicellate, arising from nodes of the rachis, often showy. Bracts small or caducous.

A genus of several species, inhabiting the warmer regions of the globe.

1. *M. GIGANTEA* DC. (*Enum. No. 107.*) A tall climber. Leaflets ovate, rounded at the base, obtuse at the apex, $2\frac{1}{4}'$ – $4'$ long, the two lateral ones often unequal, glabrous. Racemes near the end of a peduncle, $4'$ – $6'$ long, the pedicels approximate, $6''$ – $8''$ long, puberulent. Calyx $4''$ long, quite truncate, or with very short teeth, puberulent. Wings and keel $1'$ long, nearly twice the length of the standard, glabrous or nearly so, sometimes with a line of hairs along the edge of some of the petals. Ovary few-ovuled, sericeous, stipitate. Pod

stipitate, about $2\frac{1}{2}$ ' long, $1'-1\frac{1}{4}'$ wide, flattened, very pubescent when young, but becoming glabrous with age. Seeds nearly 1' in diameter, orbicular.

Puna, Hawaii (is the only place recorded). Also on other Pacific Islands, and East Coast of Australia.

2. *M. URENS* DC. (*Enum. No. 108.*) A very tall climbing vine; the young branches, peduncles, &c., sericeous with fine hairs. Leaflets ovate, acuminate, with scattered soft hairs above, below densely silky with soft silvery hairs, $2\frac{1}{2}'-5'$ long, $1\frac{1}{2}'-3'$ wide, lateral ones unequal. Rachis flexuose, 10-15 flowered. Bracts ovate, obtuse, $\frac{3}{4}'$ long, sericeous. Flowers large, 2' long, bright yellow with some red, very showy. Calyx 1' long, unequally 4-cleft one-third down, the hairs at the base fulvous and somewhat spreading, those higher up more appressed. Standard reflexed, glabrous as are the rest of the petals, and about two-thirds their length. Pod very thick, with wrinkled valves, ovate, acuminate, nearly or quite sessile, covered with fulvous stinging hairs (the cow-itch of commerce), usually one-seeded. Seed much as in the first species.

Waimea, Hawaii. Woods above Makawao, East Maui; and probably elsewhere. Also in tropical America and the West Indies.

10. DIOCLEA HBK.

Calyx campanulate, 4-cleft (*i. e.*, the 2 superior lobes are connate). Standard orbicular or ovate, reflexed, appendiculate at the base with inflexed auricles. Wings obovate or oblong, free, nearly as long as the keel, which is incurved, and beaked or obtuse. Stamen next the standard free at the base, but joined to the others in the middle: anthers uniform, or the alternate ones smaller or wanting. Ovary nearly sessile, 2-many-ovuled. Style incurved, not bearded, thickened or dilated near the apex; stigma terminal, truncate. Pod linear-oblong or somewhat orbicular, compressed, coriaceous, the upper suture dilated or winged, 2-valved. Seeds flattened, with a short or long hilum. — Tall climbing or spreading shrubs. Leaves 3-foliolate, with stipellæ. Flowers violet or white, fasciculate-racemed on a thick peduncle, the fasciculæ sessile on the rachis or elevated on a short peduncle. Bracts very caducous, as also the bractlets.

A small genus, mostly in tropical America; a few species are found in the tropical parts of the Old World.

1. *D. VIOLACEA* Mart. (*Enum. No. 109.*) Young branches, &c., pilose-hispid. Leaflets oval or oblong-oval, obtuse at both ends, strongly parallel-veined, the veins oblique, coriaceous, shining and glabrous above, finely hirsute with glossy brownish hairs below, $3'-5'$

long, $2\frac{1}{2}$ ' - 3' wide. Peduncle very thick, branching into short partial peduncles, 2" - 3" long, which each bear a few flowers. Flowers about $\frac{1}{2}$ ' long, dark purple or violet. Pedicels 1" - 2" long. Calyx 4" - 5" long, finely pubescent, and split nearly half way down into 4 lobes, 3 of which are narrow and acute, the other broad and obtuse or emarginate. Pod 3" long, $1\frac{1}{2}$ ' wide, very much flattened, smooth.

Vicinity of Hilo, Hawaii, in open land. Kanai. Probably indigenous to Polynesia, whence it comes also from the Viti and Society Islands, though also found in Brazil.

11. CANAVALIA Adanson.

Calyx tubular-campanulate, the 2 upper lobes united in a large entire or 2-lobed upper lip, the three lower teeth very small, free or united into one. Standard large and broad, reflexed. Wings and keel rather shorter, curved or sometimes slightly twisted. Upper stamen free at the very base, but united with the others in the middle. Ovary barely stipitate, many-ovuled. Style filiform or slightly thickened in the upper part, with a terminal stigma. Pod oblong or broadly linear, usually large, flattened or rarely turgid, with a prominent wing or rib on each side of the upper suture. Seeds with a linear hilum. — Twinning or trailing herbs. Leaflets 3, with small stipellæ. Stipules usually very small. Peduncles axillary, bearing in the upper part a few 1 - 3-flowered nodes. Flowers rather large, purple, pink, or white. Bracts and bractlets small and caducous.

A small genus, of the hot and tropical parts of the globe.

1. *C. GALEATA* Gaud. (*Enum. No. 110.*) Stem slender, twining often to a great height on trees, the shoots and leaves more or less pubescent when young, soon glabrate or quite glabrous. Stipules minute, ovate-subulate, caducous. Leaflets ovate elliptical or oblong-ovate, more or less acuminate, rounded at the base, membranaceous, $2\frac{1}{2}$ ' - 5' long, $1\frac{1}{2}$ ' - $3\frac{1}{2}$ ' wide. Racemes 3 - 10-flowered, rather shorter than the leaves. Flowers $1\frac{1}{2}$ ' long. Upper lip of the calyx recurved in flower, very large even for the genus, 3" - 4" long, strongly emarginate or somewhat 2-lobed; the short lower lip 3-cleft, its lateral lobes ovate or triangular ovate and obtuse, the middle one more triangular and acute. Corolla pink or purplish-pink; the obovate and emarginate standard rather longer than the wings and keel. Ovary silky-canescens, many-ovuled. Pod linear-oblong 4' - 6' long, 1' or more wide, straight, compressed, when half grown silky, at maturity glabrous, slightly tricarinate at the ventral suture, apiculate, short stipitate. Seeds 6 or 7.

Rather common in many places in woods.

12. PHASEOLUS Linn.

Calyx campanulate or nearly tubular, 5-toothed or lobed, rarely 4-toothed by the union of the 2 upper ones. Standard orbicular, recurved or sometimes slightly twisted. Wings obovate or rarely oblong, equalling or longer than the standard, adhering above to the keel, often twisted. Keel produced at the top into a long and spirally twisted beak. Stamens diadelphous; anthers uniform. Ovary nearly sessile, many-ovuled. Style thickened and cartilaginous in the upper part, usually bearded longitudinally under the stigma, which is more or less oblique or lateral. Pod linear and nearly cylindrical, or more or less flattened and falcate, with several seeds. — Herbs, rarely woody at the base, either dwarf or prostrate, or more frequently twining. Leaflets 3, rarely reduced to one, stipellate. Peduncles axillary, bearing in their upper part several 2-3-flowered nodes. Corollas glabrous, white, yellowish, red, or purple. Bracts usually caducous. Bractlets often large, and somewhat persistent.

A considerable genus, widely dispersed throughout the hot regions of the globe.

1. *P. TRUXILLENSIS* HBK. (*Enum. No. 111.*) A twining herb, more or less pubescent or glabrous, the hairs on the stem reflexed, those on the leaves appressed or silky. Leaflets broadly-ovate or narrowly linear-oblong, obtuse or acuminate, rounded at the base, the lateral ones often oblique and unequal, 1'-3' long, 1½'-2' or more wide; stipellæ minute, oblong; stipules small and not decurrent. Peduncles somewhat elongated, few-flowered near the apex; pedicels 1''-5'' long. Bractlets shorter than the calyx, striate, coriaceous, and deciduous. Flowers large, nearly 1' long, purple, whitish-rose-colored or violet. Upper calyx-lobe short, broad, and obtuse, the others longer, acute or acuminate. Pod compressed, straight or falcate, 2'-5' long, 3''-4'' broad. — *Ph. rostratus*, Wall.

Oahu. Hawaii. Also in other Pacific Islands, in South America, East Australia, and most tropical countries.

2. *P. SEMIERECTUS* Linn. (*Enum. No. 112.*) Stem erect or ascending, rarely twining above. silky or glabrescent. Leaves ovate, acute, or obtuse, glabrous above, minutely hairy beneath, rather firm in texture, 1½' long, ¾' wide, the lateral ones more or less unequal-sided. Raceme few-flowered, at the end of a very much elongated (12'-18') peduncle. Flowers dark purple. Pedicels almost none, at length recurved. Calyx-teeth ovate-lanceolate, pointed, five in number, and nearly equal. Pod nearly cylindrical, silky, or with age glabrescent, linear, 3'-4' long, about 1'' in diameter, acuminate beaked, straight or slightly curved, reflexed.

Moist land near taro ponds, &c. Common in many places. Also in East and West India, South America, &c.

Phaseolus lunatus, a variable species, which furnishes the Lima bean, Sieva bean, &c., has rather small white flowers, and broad, curved pods, with large, flat seeds.

13. VIGNA Savi.

The two superior teeth of the calyx connate or distinct. Standard orbicular, appendaged with inflexed auricles at the base. Wings hardly shorter than the standard. Keel equalling the wings, incurved, erostrate or with a partially curved beak. Stamens diadelphous; anthers uniform. Ovary sessile, many ovuled. Style filiform or thickened above, longitudinally bearded on the inner side. Stigma very oblique or lateral. Pod linear, straight or nearly so. — Climbing or prostrate herbs, or rarely erect. Leaves 3-foliolate, stipellate. Stipules often decurrent. Flowers yellow, or rarely simple, fasciculate-racemed at the apex of axillary peduncles. Bracts and bractlets small, caducous.

Genus of several species, and spread through the hot regions of the globe.

1. *V. LUTEA* Gray. (*Enum. No. 113.*) A prostrate vine, several feet long. Peduncles, petioles, and leaves hirsute with scattered hairs when young, soon glabrous. Leaflets obovate or orbicular, very obtuse, or even retuse, somewhat tapering at the base, triplinerved, 2' - 4' long and as wide or nearly so. Racemes on short peduncles, not as long as (often much shorter than) the leaves, few-flowered. Flowers yellowish, 6'' - 7'' long, on pedicels 1'' - 2'' long. Calyx-lobes broad and obtusish. Pod 1½' - 3' long, not much compressed. Seeds several, chestnut-brown.

Oahu, Hawaii, Maui; often by the seashore. Also in many tropical countries.

2. *V. OAHUENSIS* Vogel. (*Enum. No. 114.*) Plant with much the habit of the last. Peduncles, petioles, &c., sericeous when young. Leaves ovate, usually acute, rounded at the base, not triplinerved, but rather strongly parallel-veined, glabrous on both sides, 1½' long, 1' or more wide. Flowers about 7'' - 8'' long. Calyx-lobes broad, acute, or the upper obtuse. Pod about 2' long, curved at the apex. Seeds black.

Kaala Mountains, Oahu. Maui. Kauai. The species imperfectly known.

3. *V. SANDWICENSIS* Gray. (*Enum. No. 115.*) Root tuberous? "edible." Stems slender, twining, retrorsely hirsute-pubescent, as also the petioles and peduncles; the leaves pubescent on both sides in a similar manner. Stipules and stipellæ subulate, minute. Leaflets linear or linear-lanceolate, or ovate-lanceolate or even ovate and very obtuse and rounded at both ends, of a rather firm texture, 6'' - 18''

long, $1\frac{1}{2}$ "-9" wide, on very short petioles. Pedicels opposite, 1-flowered, 3"-9" long. Flower almost 1' long. Calyx deeply 4-lobed, subtended by a small deciduous bractlet; the teeth nearly equal, about as long as the tube; the uppermost ovate, very obtuse, or slightly emarginate; the others acute. Corolla bright yellow; standard obovate. Ovary hirsute, many-ovuled. Style filiform, much longer than the ovary, the upper part not thickened, the superior face strongly bearded below the lateral stigma. Pod linear, elongated, 3' long, 3" wide, flattened, nearly or quite straight, glabrate. Seeds 8-10, chestnut-brown, shining.

On Mauna Loa, above Kilauea, Hawaii. East and West Maui, Oahu, and Kauai.

14. DOLICHOS Linn.

Calyx campanulate, its teeth short, the two upper nearly or quite united into one. Standard orbicular, appendaged at the base with inflexed auricles. Wings adherent to the keel, which is much incurved and often beaked, but not spirally twisted. Stamen next the standard free, often thickened at the base; anthers uniform. Ovary many-ovuled. Style thickened in the upper part, and bearded under the stigma, or with a tuft of hairs at the apex. Pod linear or falcate, flattened, 2-valved, the sutures often thickened.—Herbs or undershrubs, climbing, prostrate or somewhat erect. Leaves 3-foliolate, stipellate. Stipules small. Flowers solitary or fascicled in the axils, or fascicled-racemose on peduncles, violet, yellowish, or white. Bracts and bractlets striate, usually small and caducous.

A genus of several species, in the hot parts of Africa, Asia, and Australia, a few in South America.

1. *D. LABLAB* Linn. (*Enum. No. 116.*) A prostrate or climbing stout perennial; glabrous. Leaflets broadly triangular-ovate, obtuse or acuminate, more or less truncate at the base, $2\frac{1}{2}$ '-4' long, and as wide or a little less. Flowers racemosely fascicled along a stout rachis, white or pale yellow, 6"-7" long, on short pedicels. Calyx subtended by a somewhat persistent obovate bractlet. Calyx-lobes broad and acute, except the upper one. Pod 3' or 4' long, 1' or less wide, flattened, and tipped by the curved style. Seeds quite edible, as beans.

Pauoa Valley, Oahu, and other places on the islands. Probably introduced. Common in many tropical countries.

15. CAJANUS Linn.

Calyx campanulate, 4-toothed or lobed, the upper lobe 2-toothed. Standard orbicular, with inflexed auricles at the base, and 2 callosities

inside, above the claw. Wings and keel of nearly the same length. Stamens diadelphous. Ovary with several ovules. Style thickened above the middle. Pod flattened, marked with oblique indented lines between the seeds. Racemes axillary. Bractlets none.

Genus of one species.

1. *C. INDICUS* Spreng. (*Enum. No. 117.*) An erect undershrub 2°-3° high, more or less covered with a short soft tomentum. Leaflets 3, broadly lanceolate or oblong, acute, 1½'-3' long. Stipules lanceolate, deciduous. Peduncles axillary, bearing at the summit a short raceme of flowers, either entirely yellow, or the standard veined outside with purple. Pedicels about 6" long. Pod 2'-3' long, with an incurved point, more or less glandular and hairy.

Around habitations. Probably introduced, but widely scattered throughout the tropics. Often cultivated for its fruit, the *dhal* of the East Indians, which make a good substitute for green peas.

TRIBE VII. SOPHOREÆ.

Trees, shrubs, or very rarely herbs or undershrubs. Leaves pinnate, of 5 or more, very rarely 3 or 1, leaflets. Stamens all free. Pod continuous (not jointed), but sometimes torose, indehiscent or 2-valved.

16. SOPHORA Linn. [*Mamani.*]

Calyx campanulate, shortly 5-toothed. Standard rather broad. Keel petals equal to, or rather longer than the others, scarcely cohering on the outer edge. Stamens free. Ovary short-stalked, many-ovuled. Style glabrous with a minute terminal stigma. Pod cylindrical or slightly compressed, fleshy, or hard and woody, much contracted between the seeds, and usually indehiscent. Radicle curved. — Trees, shrubs, or very rarely herbs. Leaves pinnate, the leaflets usually opposite, with a terminal odd one. Racemes simple, or several forming a terminal panicle. Bracts minute or none.

A genus of several species, found in the hot regions of the globe.

1. *S. (EDWARDSIA) CHRYSOPHYLLA* Seemann. (*Enum. No. 118.*) A small tree (with very hard and durable wood) 20°-30° high, variable in its foliage, pubescence, &c. Leaflets oval or oblong, 5-10 pairs, often alternate, obtuse, and at the apex usually retuse, 5"-15" long, 3"-7" wide, on the upper surface soon glabrous and shining, beneath silky pubescent, the pubescence with either a tawny or a silvery hue. Flowers on few-many-flowered short axillary peduncles, or pedicels 7"-8" long, the peduncles, pedicels and calyx, finely tomentose. Calyx about 3" long; lobes very broad and obtuse. Petals 1' long, yellow, the broad standard recurved. Stamens as long as the keel. Ovary tomentose. Pod 4'-6' long, often very much constricted between the seeds, with 4 narrow wings 1" or more broad, 2-valved at

[To be continued.]

X. *Observations on Polyzoa. Suborder Phylactolamata.*

BY ALPHEUS HYATT.

[Continued from page 160.]

CENŒCIAL BRANCHES,

Diffuse or adherent. Variety *b*, of *Fredericella Walcottii*, has its branches closer together than variety *a* of the same species; but the only specimens yet described, either in this country or in Europe, that have crowded branches, are those belonging to variety *c*, of *Fredericella regina*.

Among these, a branch may occasionally become adherent for a short space. This, however, rarely occurs, and seems to be wholly accidental. The diffusion of the branches is the ordinary character of *Plumatella*, but in four of the five American species, the crowded Alcyonelloid variety is developed more or less, according to the locality in which the species lives. I have been unable to determine whether the crowding of the branches takes place by the direct action of physical causes or not. In some cases the area of attachment would seem to be the only assignable cause, as in *P. vesicularis*, where the tip of a branch assumes the Alcyonelloid character by being crowded upon the edge of a projecting branch,* but the same variety in *P. vitrea* grows upon the smooth surface of a piece of tin. In *P. Arethusa* and *F. regina*, found in Tommy's Brook, near Gorham, Me., the current seemed to be in some way connected with the production of the Alcyonelloid variety; but the same varieties of the three other species of this genus developed profusely in the brackish and still water of Mystic Pond; upon broad surfaces of attachment in the still fresh water of Spy Pond, and in a small artificial lake on Mr. John Hopkins' estate near Baltimore. In fact, there is no uniformity in their mode of occurrence, the same form often appearing under the most diverse circumstances. The quantity of food may possibly influence their growth, though with regard to this I have collected no reliable data.

* See description of species.

As will be seen in the descriptions of the species, although the same varieties occur in different localities, and under diverse physical conditions, still the specimens even of different species in each locality usually have a similar character. The adhesion of the branches is owing entirely to the juxtaposition of young cells, whose softer ectocysts adhere to one another, and it is therefore a characteristic which may occur in any species when the young cells are accidentally brought in contact.

Tubular. All the *Fredericellæ* have tubular branches, the zooids being arranged in a single series.

In *Plumatella Arethusa* the tubular characteristic is retained even in variety *b*. In variety *b* of *P. diffusa*, however, the branches coalesce to a considerable extent; and in varieties *b* and *c* of *P. vitrea*, either single branches or whole colonies may have the polypides in bunches, approximating to the mode of growth exhibited by *Pectinatella*. The branches of *Lophopus* are true lobes containing a fascicle of polypides at the end of each branch, and those of *Pectinatella* are also lobes, but with the polypides placed in long, double rows on the upper sides. This lobation, therefore, arises as a characteristic of the varieties or even as a peculiarity of one branch of a colony, as in *P. vesicularis*,* and becomes of generic value in *Lophopus*, *Pectinatella*, and *Cristatella*, entirely superseding the tubular form of the branches in *Fredericella*, *P. Arethusa*, and the varieties of the remaining American species.

CŒNOCIAL CELLS.

Distinct. In *Fredericella* the cells are distinct from each other; occasionally by some accident, as previously mentioned, a branch may become adherent to a neighboring branch, but the cells never appear to do so. The cells of the *Plumatellæ* are adherent in all their *Alcyonell*-oid varieties.

Cell-walls entire. Wherever the cells are distinct, the cell-walls must be entire. When, however, the former be

* See description of species.

come adherent, the attached portion of the cell is shortened, and consequently the walls of the free portions of the cells approximate. In some specimens of variety *b*, *Plumatella Arethusa*, this approximation takes place without any sensible diminution of the lower portion of the free part of the cell-walls; but in variety *b* of *P. diffusa*, and in the single branches of *P. vesicularis*, previously mentioned, there is a very decided shortening of these walls, and in *P. vitrea* only the orifices project above the branch in some groups, while in others the free portions of the cells are quite long. In *Lophopus* the cells have similar characters, the whole lower portion of the dividing walls becoming part of the common surface of the lobe, and in *Pectinatella* and *Cristatella* the cells are entirely obliterated, the dividing walls having disappeared. Thus the entireness of the cell-walls is a diminishing characteristic of generic value in *Fredericella*, of specific and variable value in *Plumatella*, disappearing in *Lophopus* and *Pectinatella*. The only reasonable cause for this gradual obliteration of the cell is to be found in the agent which crowds the branches and cells together, making them adherent, which produces the lobes of *Lophopus*, and consolidates them with the cœncæcial trunk in *Cristatella*, and which also completes the radiatory arrangement of the polypides, namely, the increasing activity of the reproductive function, as shown in the greater number of buds produced from the mother cell. The cœncæcial trunk of *Fredericella* and *Plumatella* is made by the growth of the primary polypides. When several buds develop simultaneously, this cœncæcial trunk is broadened and becomes a common cavity containing the various polypides, as in variety *b* of *Plumatella vitrea*.

A farther development of the flabellate growth gives the palmate aspect of the branches in *Lophopus*. A greater increase in the number of buds growing from the mother cell gives, as has been said in the article on reproduction, the radiatory character of *Pectinatella*, and also broadens the cœncæcial trunk at the expense of the branches, which become short lobes.

Finally, so many buds are produced simultaneously, that they crowd themselves together in quincunx order, instead of forming distinct radiatory branches, as they would do if developed singly or in pairs at intervals, the whole being a greatly distended primary cell or cœncœcial trunk. This view is sustained by the occurrence of the buds upon the border in the same place, with relation to the polypides of *Cristatella*, that they occupy in the single cells of *Fredericella* and *Plumatella*, and in the lobes of *Pectinatella*.

Irregularly divided by permanent internal folds of the endocyst. These folds are present more or less in nearly every colony of *Fredericella* and most of the diffusely branching *Plumatellæ*, but not in the *Alcyonelloid* varieties. I suspect, however, that variety *b* of *Plumatella vitrea*, has them. If so, they probably act as in *Lophopus*, and isolate the branch in which they occur.

The peculiar aspect of the constrictions in *Plumatella*, bending inwards from the stiff ectocyst and apparently prevented from coming together by its unyielding nature, their accidental occurrence in any part of the branch, and their being simply an annular constriction of the endocyst, all go to prove, as has been shown in the article on reproduction, that they are the homologues of the constrictions that divide and multiply the cœncœcia in *Pectinatella* and *Cristatella*.

ECTOCYST.

Thin. The *Fredericellæ* all have thin ectocysts. There is a variety of *Fredericella Regina*, and one species, *F. pulcherrima*, which have colorless ectocysts, but these are not thicker than the horny coverings of the other varieties.

The *Plumatellæ* have thin ectocysts, except in *P. vitrea*. In this they are somewhat thicker than in other species. In *Lophopus* it is very thick below, indicating the final withdrawal of the whole under the cœncœcium in *Pectinatella*. Its immense thickness, in the last genus, is directly caused by the surface of attachment

and the activity of the fissiparous function of the cœnœcium. Even upon a level surface the continued multiplication of the cœnœcia, in course of time, crowds them together and presses the central colonies gradually upward, forcing them to excrete more gelatine, and thus the central portion of the general ectocyst becomes the thickest.

Thus the thickness of the ectocyst is not a regularly progressive character, and the fluctuation appears to be caused by the peculiarity of the base of the attachment, and the multiplication of cœnœcia by self-division in *Pectinatella*.

Parchment-like or gelatinous. This is the condition of the ectocyst in all the *Fredericellæ*, even the colorless varieties are tougher than the colorless varieties of *Plumatella*. The *Alcyonnelloid* varieties of *Plumatella* are more generally surrounded by a gelatinous ectocyst than the diffuse varieties.

Brown, or colorless. These characters accompany the preceding, the parchment-like being always brown, and the gelatinous always transparent.

Permanent throughout life. The parchment-like ectocysts of *Fredericella* long survive the decay of the polypides, but the gelatinous disappear soon after their decay. The same rule obtains until we reach *Pectinatella*. In this genus, the thickness of the mass causes it to commence decaying before the colonies die, and they often are found loosely scattered on the surface after it has decayed to a thin sheet. This gives to an old settlement of the *Pectinatellæ* a *Cristatellian*-like aspect, since in the latter the ectocyst is thin.

The old colonies of *Pectinatella*, however, do not lose the power of excreting gelatine, but readily refasten themselves after being detached. The loss of permanency in the ectocyst of *Pectinatella* is fittingly followed by its appearance in *Cristatella* as a transient excretion.

Envelopes the entire cœnœcium. This character has been treated of in mentioning the cause of the natural position of the cœnœcium. It is strictly decremental,

since, as previously noticed, *Lophopus* forms an intermediate step to its passage under the cœncœcium in *Pectinatella*.

CŒNCŒCIAL ENDOCYST.

Cells of the first membrane small and depressed. This character, and its subsequent change to the larger cells of *Pectinatella* and *Cristatella*, was described in the article on the "Composition of the Body." It is due, perhaps, to the removal of the pressure of the superincumbent ectocyst from the upper side of the cœncœcium.

Cells of the second membrane small. This character, which appears to be invariable, may possibly owe its equability in the size of the cells to the equal pressure of the other membranes on either side.

The remaining characters need no explanation until we reach

FREE STATOBLASTS.

Bean-shaped, depressed, or elongated ellipses. The variability of the statoblast, as will be seen in the description of the species, becomes less in *Plumatella*, and is of fixed value in *Pectinatella*.

The depressed elliptical forms are in reality orbicular forms, or are those varieties which assume a close approximation to the outline finally taken by all the free statoblasts of *Cristatella*.

Thus it may be said of the three forms which begin as varieties in *Fredericella*, of which the bean-shaped is perhaps the most common, that they all successively culminate in some one genus, and then die out. Thus the bean-shaped disappears in *Plumatella*, the elliptical takes its place in the latter and in *Pectinatella*, and the orbicular form, which only holds a place in the varieties of the different species of the preceding genera, at length predominates and is characteristic of the genus in *Cristatella*.

RECAPITULATION OF THE CŒNCŒCIAL SYSTEM.

The synopsis itself sufficiently explains the remaining characters of this system, and we may, therefore, proceed

without fear of misunderstanding to the consideration of its general features. There are six characters; (1) single character of the cœnœcium, (2) a character in the diffusion of the branches, (3) a character in the tubularity of the branches, (4) a character in the perfection of the branches, (5) a character in the distinctness of the cells, and (6) a character in the entireness of the walls of the cells, all of which are decremental, the decrement being traceable directly to the activity of the reproductive function, which increases, (1) the radiatory character of the cœnœcia, (2) the crowding and adherence of the branches, (3) the lobiform character of the branches, (4) the consolidation of the branches with the cœnœcial trunk, (5) the adherence of the cells to each other, and (6) the merging of the cell-walls into the common surface of the branch. All of the latter are respectively antagonistic to the former, and although produced by the same agent, and occurring primarily either upon different branches of the same colony, different varieties of the same species or different species of the same genus, finally become of generic value,* exclude the former, and change the whole aspect of the cœnœcium in *Cristatella*.

Secondly, there is a series of characters; (1) a character of adherence of the ectocyst to surfaces, and of the endocyst to the ectocyst, (2) the parchment-like character of the ectocyst, (3) its permanency throughout life, all of which decrease as the ectocyst becomes more gelatinous and retrogrades from a protective covering to a transient excretion. Thirdly, there is a series, (1) the erectness of the free branches, (2) the envelopment of the cœnœcium, (3) the small size and depressed form of the cells of the outer membrane, all characteristics which disappear when the ectocyst retires from the upper side of the cœnœcium. Fourthly, (1) the number of branches in a single colony, a decremental character, (2) the permanency of

* By "generic value" it is not meant that a variety may become a species, or a species a genus by evolution, but that characteristics apparently of accidental growth in the distortion of a branch, or in the variety of a species, may finally become peculiar to some species, and then an essential characteristic of a higher genus.

the annular folds, a decremental character, (3) the thickness of the ectocyst, a fluctuating character. The decrement of the first two and the fluctuation of the last being due to the increasing functional activity of the third membrane in forming annular folds, which is apparently due to the same character as the second series, namely, the increase in the gelatinous nature of the ectocyst.

EVAGINATORY SYSTEM.

ALIMENTARY CANAL.

Membranes fully developed. The invariability of the cellular structure of the membranes of the canal is, probably, as in the case of the evaginable endocyst, due to the similarity of the circumstances and positions occupied by them with relation to the surrounding parts and fluids.

Lies straight in the cœnoecium when invaginated. The cells in *Fredericella* and *Plumatella* are not generally of sufficient capacity to admit of any doubling on the part of the alimentary canal, and, since there is room enough for it to lie straight, it naturally assumes that position.

The location, also, of the bases of the retractors are at such a distance from the orifice of the cell, that it is out of the question for the gastric retractors to act in such a manner as to double the alimentary canal on itself.

In variety *b* of *Plumatella vitrea*, however, the bases of the muscles are nearly opposite the cœnoecial orifice, and it would be inferred, from the similarity of their positions to those in *Pectinatella*, that the canal must double upon itself when undergoing retraction; but, although the lophophore is very closely withdrawn, the canal floats freely in the chamber (Pl. 9, fig. 1). The position of *Pectinatella*, as figured in Pl. 9, figs. 12, 13, shows that the canal is not only bent ventrally, but when completely drawn in, the anterior end of the cœcum lies between the trunks of the retractors. In *Cristatella* this tendency is expressed more strongly, the canal, passing between the trunks of the retractors ventrally lies in precisely the reverse position to what it did in *Fredericella* and *Plumatella*.

The length proportionally to the length of the evaginable endocyst above the orifice. This character is very important. It shows the gradual progress of the alimentary canal out of the cœnœcium, in proportion as the evagination of the polypide becomes more extended.

Although the canal is absolutely very much larger in *Pectinatella* than in any other genus (vide synopsis, proportion of the greatest dorso-ventral, to the greatest antero-posterior diameter), its position with relation to the lower edge of the invaginated fold does not change as long as that fold exists. When, however, there is no fold as in *Cristatella*, the region of the sphincter crosses the cœcum near the end instead of its former place, just below the intestinal valve. (Pl. 14, fig. 1.)

The length, however, with relation to the length of the evaginable tube and the extent of the canal exposed by its increasing evagination, is an incremental character, and shows farther how the destruction of the walls of the cells affects the size of the canal. The *Fredericellæ* with their long, narrow cells, have also long, narrow canals; the cells becoming wider in *Plumatella*, the stomachs are correspondingly wider; and in *Pectinatellæ*, where the evagination removes the invaginated fold, giving a wide orifice, and where there are no cells, it attains, comparatively, an immense size.

In *Cristatella*, the evagination being perfected, and the amount of room in the cœnœcium very much reduced, it returns again to a smaller size, but retains nearly the same proportions of the dorso-ventral and antero-posterior diameter (see next character in the synopsis) which it had acquired in *Pectinatella*.

The consequence of this reduction in the absolute size renders the whole but little longer than the fully evaginated endocyst, and the canal may, therefore, be said to follow the tube out of the cœnœcium.

Proportions of the dorso-ventral to the antero-posterior diameter. This character has been sufficiently explained above, with the exception of the measurements. These were taken, the dorso-ventral just below the phyloric

valve, and antero-posterior from the lophophore to the end of the gastric cœcum.

Œsophagus. The proportion of antero-posterior diameter to the length of the stomach from the œsophageal valve to the end of the cœcum, varied but little from $\frac{1}{2}$ in each genus. But the next character, the proportions of its own antero-posterior to its own dorso-ventral diameter, show a determinate and steady decrement in its length.

Stomach. The proportions of the dorso-ventral to the antero-posterior diameter determine the fact stated above with regard to the increase in the size of the canal to *Pectinatella*, and its decrease or fluctuation in *Cristatella*. In addition to the decrement in the length of the œsophagus, there is also a decrement in the ventro-dorsal from what it is in *Pectinatella*, $\frac{1}{2}$ of the antero-posterior, to only $\frac{1}{4}$ the latter, very nearly the same proportions it had originally in *Fredericella*. The next proportion, however, shows a curious fact. Although there is this decrease in ventro-dorsal diameter there is an increment in the dextro-sinistral diameter; or, in other words, the stomach retains in *Cristatella* the great breadth of the dextro-sinistral diameter, which it attained in *Pectinatella*: while, on the other hand, it loses the increment of the ventro-dorsal diameter. This explains the greater breadth of the alimentary canal, when seen from the dorsal side in *Cristatella*, as compared with its narrow look when viewed laterally.

Intestine. Only one series of measurements was made of the intestine, ventro-dorsally near the pyloric valve, and antero-posteriorly from the valve to the anus. The proportions of these two diameters appeared to be invariable; but, nevertheless, the absolute size of the intestine is greater in *Plumatella* and in *Pectinatella*, than in any other genus. In *Cristatella*, like the stomach, it became—when seen from the side—very narrow, but is of *Pectinatellæan* proportions when seen in front or dorsally.

RETRACTORS.

Œsophageal Retractors. The characteristics preceding the proportional breadth of this branch of the retractors

to the dorso-ventral diameter of the tube are plain enough in the synopsis, and need no explanatory remarks. This, however, is a fluctuating character, while all the above mentioned are incremental characters.

The breadth of the muscle was measured near the lophophore; and the breadth of the tube from the brachial collar to the junction of the arms with the tube.

The fluctuation in *Cristatella* is due to the sudden increase in the breadth of the tube in this genus, and not to any decrease in the absolute breadth of the muscle, compared with what it was in *Pectinatella*.

Brachial Retractors. The breadth was measured across the tube, as in the œsophageal retractors. All the characteristics of the retractors, as read in the synopsis, are directly traceable to the increasing evagination of the polypide.

As the polypide protrudes farther out of the cœncœcium and the invaginated fold disappears, the œsophageal and brachial retractors lose the support which it afforded them in *Fredericella*; and the increase in the size and diffusion of their filaments and bases is to compensate for this loss, and to enable them to govern the motions of the crest with their former facility.

The increment of the number of the bands of the gastric retractors, however, although due to the same causes that bring about the increase in the degree of evagination, are more directly affected by the greater freedom given to the alimentary canal by these changes. In *Fredericella*, the number of bands is at its minimum, because the stomach is confined in a narrow tube; and in *Pectinatella* and *Cristatella* at its maximum, because they are required to confine the alimentary canals of the different polypides, and prevent them from interfering with each other in the common cœncœcium.

ANTERIOR RETENTORS.

One row. These being merely the lowermost row of posterior retentors, and differing from them only in their size, there is necessarily but one row in every species throughout the group.

The number of the bands, however, is dependent upon the width of the orifice, and since this becomes gradually broader up to the maximum in *Pectinatella*, and then decreases in *Cristatella*, they have a corresponding fluctuation in the number of the bands.

Far removed from the orifice. The distance of the posterior attachments from the orifice is measured by the breadth of the invaginated fold; and as this decreases, they of course come nearer to the edge of the opening, finally resting on the edge itself.

POSTERIOR RETENTORS.

The decrement in this series is explained by the preceding paragraph, since, as in the last characteristic, the number of rows is determined by the breadth of the invaginated fold.

SPHINCTER MUSCLE.

This being coextensive with the fold, necessarily decreases with it.

INVAGINATED FOLD.

This decreases in precisely the same proportion as the evaginable endocyst increases. And, in fact, it could not well be otherwise; since, as previously stated, the increase in the length of the evaginable endocyst or tube is wholly due to the additions made to it by the freed portions of the decreasing invaginated fold.

EVAGINABLE ENDOCYST.

The measurements were made from the anterior edge of the invaginated fold to the lophophore.

Membranes fully developed. The invariability of the cellular structure of the membranes is due, probably, to the similarity of their position, and of the circumstance surrounding them throughout the group. They are not subject to any such changes, as the removal of the ectocyst gives room for in the cœncæial endocyst, and changes

in the size of the cavity of the cœnœcium do not appear to affect materially their intimate structure.

RECAPITULATION.

We have seen: (1) that the increase in the size of the Alimentary canal was due, apparently, to the enlargement of the cœnœcium, occasioned by the obliteration of the cell-walls in *Pectinatella*, and its decrease to the subsequent redivision of the cœnœcium into cells in *Cristatella*; (2) that this increment and decrement was confined to the stomach and intestine, the œsophagus steadily decreasing in the proportions of its length to its breadth throughout; (3) that the passage of the whole alimentary canal out of the cœnœcium, when the polypide is evaginated, is due to the increasing length of the evaginable tube, and therefore referable to the increasing evagination of the polypide; (4) that the increasing size and diffusion of the anterior bases and posterior filaments of the retractors, was also due to the increasing evagination of the tube; (5) that the increase and decrease in the number of the anterior retentors was due to the increase and decrease in the size of the cœnœcial orifice; and (6) that the approximation of the anterior retentors to the orifice, the decrease in the breadth of the sphincter, and the increasing length of the evaginable endocyst or tube, are due to the steadily decreasing breadth of the invaginated fold; (7) that this last is due to the decrease in the number of rows of posterior retentors, which decrease may in turn be traced* to the decreasing length of the free part of the cell-wall. Or, we may say: (1) that the free portions of the cell-wall becoming shorter, destroy the lower rows of posterior retentors; and thus (2) portions of the breadth of the invaginated fold are set free; (3) which are added to the length of the evaginable tube, and therefore the increase of the evagination is due to the decrease in length and final obliteration of the cell-walls.

Thus, in *Fredericella*, where the walls are longest, the invagination is greatest; in *Plumatella*, the walls are

* Vide description of "Muscular System."

shorter, and the invagination less; in *Pectinatella*, where there are no free cell-walls, the invagination is very much less; and in *Cristatella*, which has neither free cell-walls or lobes, the invagination is nothing. Even the zooids of the species show the action of this law. Whenever the free portions of the cells are much reduced in length, as in some zooids of variety *c* of *Plumatella vitrea*, the number of rows of posterior retentors are less, and the evagination greater, than in other zooids of the same colony, with longer walls to the free portions of the cells.

The Alcyonelloid varieties of *Plumatella Arethusa* have only about eight rows of posterior retentors; while the varieties with distinct cells may have as high as fifteen.

Thus, with the exception of the fluctuation or disturbance occasioned by the muscular walls in *Cristatella*, and the increase and decrease of the cœnœcial orifice, which causes the increase and decrease in the number of bands of the anterior retentors, all the characteristics of the evaginatory system are traceable to the decrease in the free portions of the cell-walls. In other words, to the gradual obliteration of the cells and branches. But this, as we have seen previously, is due to the activity of the reproductive function, which steadily increases the number of buds arising from the primary cœnœcial cell.

LOPHOPHORIC SYSTEM.

LOPHOPHORE.

The outline of the lophophore is an incremental character, owing its increment to the growth of the arms in *Plumatella*.

ARMS.

The length of the arms is the key-note of the changes in this system, and we shall find, as we proceed, that the increment of this characteristic determines the increment or decrement of nearly every variable characteristic.

Tips divergent—tips twisted outwards. These two characters go together. They are decremental; and the decrement is due to the retention of embryonic characters in the adults of the higher genera.

The arms of the polypides of *Plumatella* separate at a much earlier date than those of *Pectinatella*; and the latter, probably, earlier than the arms of *Cristatella*. Be this as it may, the approximation of the tips of the arms is an embryonic character; because, as already stated (remarks on reproduction), the arms in the young divide from within outward, and the tips are the last to be separated, and the longer the arms, the longer the time necessary to complete the division. It seems likely, therefore, that the embryonic character of the arms in *Cristatella* is due entirely to their increased length.

TENTACLES.

The number of the tentacles are increased in the individual, as has been shown, by additions at the tips of the arms as the latter increase in length; therefore, the longer the arms, the greater the number of tentacles. This law is carried out, not only in the different individuals of the species, but it also determines the increment in the number of tentacles from *Fredericella*, which never has over twenty-four, to *Cristatella*, which, as far as we know, never has over ninety. The length of the tentacles, however, decreases; and the decrement is due, not to any decrease in the tentacles themselves, but to the comparatively greater increase in the length of the arms.

CALYX.

The breadth of the calyx appears to be a fluctuating character.

EPISTOME.

The form of the base is an incremental character, the change from an elliptical to a crescent shape taking place when the arms appear in *Plumatella*.

TENTACULAR MUSCLES.

The number of pairs of these must be equal to the number of tentacles on any one lophophore; and since the number of tentacles is determined by the length of

the arms, the number of these, also, is determined by the same character.

LOPHOPHORIC FLEXOR.

This muscle, extending from the œsophagus to the tips of the arms, is necessarily very short in *Fredericella*, if it exists at all; and longer in the other genera, in proportion to the length of the arms.

NEURAL DIAPHRAGM.

Sufficiently explained by synopsis.

NERVE-MASS.

In *Fredericella*, where there are no arms, and the breadth of the lophophore inconsiderable, it is not necessary to have the centres of distribution widely separated, and, therefore, the nerve-mass has perhaps no commissure. In *Plumatella*, however, with its two long arms, each to be rendered capable of independent motion, and the breadth of the lophophore increased, the ganglia are probably separated by a commissure so as to correspond with these changes.

GANGLIA.

The thin, upright, spindle-like form of the ganglia, as seen from the side in *Fredericella*, is changed in *Plumatella* to a kidney-shape, lying horizontally. This corresponds precisely with increased width, which is given by development of the arms for the accommodation of the nerve-mass.

The heart-shaped appearance of the ganglia is invariable; because, when either the spindle or kidney-shaped double upon themselves by contraction, they assume the heart-shape.

The larger size of the lophophoric nerve-trunk, the greater length of the dorsal lophophoric nerve-branch and its plication, the decrease in the ventral lophophoric nerve-branch proportionally to the dorsal branch, the number of tentacular nerves, the larger size of the oral

nerve-trunk, and the increase of the thickness and size of the polypidal nerve-trunk in *Plumatella*, as compared with the states of the same parts in *Fredericella*, are all evidently due to the greater extent of the surfaces which they have to supply in the former; and this increased extent, as we have pointed out, is in its turn due to the growth of the arms. Thus, every character in the Lophophoric System appears to depend upon the increment of the arms, and to owe its modifications to that, more than anything else. The œsophageal, gastric, and intestinal nerve-branches have been observed only in *Fredericella*.

RECAPITULATION OF THE CHARACTERISTICS OF THE THREE SYSTEMS.

Commencing with the cœcnœcial system, we find that in this system the increase in the radiatory character of the cœcnœcium, the crowding and adherence of the branches, the consolidation of the branches in the cœcnœcial trunk, the adherence of the cells to each other, and the obliteration of the free walls of the cells, were all due to the increase in the number of the buds developed simultaneously from the original, or parent cell of the colony; and also, that these characteristics, primarily expressed in a slight degree either upon different branches of the same colony, or in different varieties of the same species, ultimately become of essential importance to the organization of every species and of generic value.

In the evaginatory system we found that all the characteristics, with three exceptions, were due to the obliteration of the cell-walls, and, therefore, directly traceable to the increase in the number of buds developing simultaneously from the parent cell; that the governing characteristic of the whole system, the extent of the evagination was a variable characteristic among the zooids of the same colony in *P. vitrea*, although probably of fixed and generic value in *Cristatella*. Thus most of the principal changes in the complication of the cœcnœcial and evaginatory system are traceable to one incremental characteristic, the gradual increase in the number of

buds developed from the original, or parent cell of the colony.

Besides these, however, there are other characteristics, such as the decrease in the tenacity with which the endocyst adheres to the ectocyst, finally resulting in its ability to glide easily over the surface of the latter in *Cristatella*, the decrease in the pergameneous nature and permanency of the ectocyst, all traceable to the increase in the softness and gelatinous nature of the ectocyst. And still following in the same category we find that the decrease in the number of branches to each colony, the great increment in the thickness of the ectocyst in *Pectinatella*, and the disappearance of the permanent annular folds, is due to the greater functional activity of the third layer in forming annular folds, traceable in turn to the increase in the gelatinous nature of the ectocyst, which permits these folds to coalesce and divide the colonies. Thus, there are two series of important structural characteristics, which necessarily change in consonance with, or are dependent upon the gradual change of the parchment-like ectocyst of *Fredericella*, to the gelatinous, transient excretion of *Cristatella*.

This gelatinous condition of the ectocyst, as has been shown, is only a rare individual characteristic in *Fredericella*, becoming peculiar to some species in *Plumatella*, and, finally, essential to the organization of *Pectinatella*, *Cristatella*, and perhaps *Lophopus*. I have succeeded in producing the transparent, gelatinous ectocyst in *Fredericella*, by simply allowing a colony to grow in water free from all sediment; and I have not yet found a transparent variety or species except in clear water. The transparent ectocyst is also common in the young of all the brown varieties of *Fredericella* and *Plumatella*, and these are much longer lived than the transparent species, such as *Plumatella vitrea*, the *Pectinatellæ* or *Cristatellæ*. Whether the ectocysts of *P. vitrea* would become brown and tougher if they lived longer, it is impossible to say; but certainly such would appear to be the most likely result, since the ectocyst of all the brown *Fredericellæ* and *Plumatellæ*, which live longer than they do, are trans-

parent in the young, and acquire the pergameneous character only by age. I do not here allude to the color acquired simply by the gathering on the surface of minute particles of sediment, but the deep brown color due not only to these particles, but to the horny condition of the ectocyst produced by age. The increase in the gelatinous character of the ectocyst in *Plumatella* may be safely said to be in part due to the shorter lives of those varieties, and species that are habitually transparent; but the change in *Cristatella* cannot be accounted for in any such way.

In order to see how this happens, it is necessary to notice another series of characteristics. These are the horizontality of the cœnœcium in *Pectinatella*, due to the withdrawal of the support of the ectocyst, and its concentration below the cœnœcium, which last is probably caused by the same changes in the outer membrane, that enlarge the size of the cells. The increase in the size of the minute cells, composing the tissue, are the only ostensible changes noticeable in the membrane secreting the ectocyst, to which their sudden cessation of the excretory powers on the upper side might be referred.

In *Cristatella* the ectocyst still continues to be excreted only from the lower side, and the introduction of its power of locomotion enabling it to secrete a new ectocyst as it goes, always maintains the latter new and soft. *Pectinatella* has no locomotive muscles, and, therefore, the ectocyst accumulating under it is tougher than in *Cristatella*, though it remains gelatinous in consequence of its great thickness.

The modifications of the variable character of the lophoric region, as has been said, are dependent upon the increment in the length of the arms.

The variable characteristics of the entire group of *Phylactolemata*, as may be conceived from the preceding, are dependent for their modifications or changes upon (1) the increase in the number of buds developing from the original cell, (2) the increase in the number of individuals having the gelatinous ectocyst, (3) the changes or agencies that remove it from the upper side of the cœnœcium, (4) the bending inwards of the third and fourth

muscular, and fifth membranous layers to form the reticulated walls, (5) the increasing growth of the arms.

These are the fundamental characteristics, and yet it cannot be denied that they may first make their appearance as a variable characteristic of different branches of the same colony become common to the varieties of other species, and eventually of generic value. Thus, as before described, a single branch of *P. vesicularis* assumed the aspect which afterwards distinguished variety *c* of *P. vitrea*, and approximated to the generic characteristic of *Lophopus*. The obliteration of the cell-walls in this branch and in the colonies of variety *c* of *P. vitrea* were traced to the increase in the number of buds growing up side by side from the same cell, just as in *Pectinatella* and *Cristatella* the generic form of the colony was traced to the number of buds developing simultaneously from the parent cell.

The second, also, as has been stated, appears as a rare variety in *Fredericella regina* and *Walcotti*, an ordinary character in *F. pulcherrima*, and among the *Plumatellæ* ending with becoming of specific value in *P. vitrea*, perhaps on account of the short time which that species lives, and is finally common to all the species of the remaining genera of the group. It is evidently a local characteristic, due partly to age and partly to physical causes in these two genera; but in *Lophopus*, *Pectinatella*, and *Cristatella*, it is an *essential* peculiarity of the generic structure, apparently *not affected by physical causes*, since wherever these genera have been found the ectocyst is gelatinous.

With regard to the third, it is possible that the enlargement of the cells in *Pectinatella* indicates a loss of the excretory power, and consequently causes the removal of the ectocyst. As previously stated, this change is begun in variety *c* of *Plumatella vitrea*, where the action of alcohol creates a gap between the ectocyst and endocyst.

The fourth is even more inexplicable than the third; the walls are there, and are evidently necessary to keep the cœncœcium firm and shapely, but they are apparently without precedent. They do not begin, like other char-

acteristics, in a few individuals or species, gradually becoming of generic value and general application as the complication increases, but start into life and functional activity without even a whispered warning of the coming change in the organization of any preceding genus or species.

The fifth is characteristic in different degrees of the individuals in *Plumatella* (the length of the arms always varying with the number of tentacles, and these are different in nearly every individual), and becomes much more constant, if not invariable, in *Cristatella*. Four of these five fundamental characters, therefore, are incremental. These begin in a few individuals and become of more general value and characterize more and more extended divisions and more complicated animals. Thus the second is an individual variety in the first genus, obtains a more general application and finally a specific value in the second, and at last is sufficiently constant in the two species of *Cristatella* already known, to be considered at least of generic value.

The increased value, or constancy and applicability, therefore, of these incremental characteristics is due entirely to the increase in the number of the individuals characterized by them in each succeeding and more complicated division, with regard to the number of the individuals that remain unchanged in the same division. For example, in *P. arethusa* the majority are brownish, wherever found; in *P. vesicularis* there are few brown individuals in proportion to the transparent; in *P. vitrea* all yet found are transparent; and in the succeeding genera every individual is transparent.

The fourth character must be considered an exception to this rule, unless indeed new discoveries should disclose an intermediate form between *Cristatella* and *Pectinatella*, or a lower form of the same genus that will give us the clue to the abrupt introduction of the reticulated walls.

It is surprising that when viewed with regard to their own young, the condition of the cœncæcial and lophophoric regions in *Cristatella*, although more complicated, is nev-

ertheless more embryonic in some respects than the evaginatory region in the same genus, or in *Plumatella*.

Nothing can be more opposed to the fully evaginated state of the adult *Cristatella* than the embryonic aspect of the lophophore, and it will be readily perceived, from the homology suggested between the original cell of the colony, and the sack-like cœncœcium, that the latter has a more embryonic aspect than the branching cœncœcium of *Plumatella*. This is the only point in which the lophophoric and cœncœcial regions agree; in all others they are at variance.

Such would be inferred to be their most appropriate relationship, from the fact, that all the modifications of the evaginatory tube were found to be due to the more fundamental changes of the cœncœcium; whereas, those of the lophophore were not dependent upon any of the changes in the other two. Thus the lophophoric adds its greatest increment of complication, the "fully developed" arms, in the second genus of the sub-order, whereas the cœncœcial more gradually progresses and acquires its greatest anatomical increment, the reticulated walls, only in the last genus. Both are most complicated in *Cristatella*, but both arrive at the highest degree of complication by different methods.

The evaginatory region does not agree with either of these; the increment of complication is gradually and slowly added, and no new organs or sudden developments of particular parts take place. In all its relations with the regions above and below, this region occupies an intermediate place.

In fact, the mutual influence of the modifications in one region upon the organs of another is proportional to their positions in the body of the adult, and the times of the acquisition of the adult characters by such region during the development of the individual.

The modifications of the cœncœcial region, situated as it is at the anterior pole, bear directly on the next region, the evaginatory, changing its organs greatly, but it does not affect the lophophoric at the posterior pole of the body. The forces or organic momenta of the changes

seem to be expended entirely upon the evaginatory system, and do not reach the lophophoric except in so far as they increase its distance from the anterior pole by increasing the evagination of the tube.

The cœncœcial is also invariably the first region to assume the full characteristics of the adult zooid, the evaginatory next, and the lophophoric last. The bud, as previously observed, is developed from the wall of the cell, which last becomes well formed and distinct before the alimentary canal loses the peculiar shortness and breadth of the younger stages of growth, such as is figured in Pl. 8, fig. 2, and not until long after both regions have attained their full growth, do the tentacles on the ends of the arms acquire the adult length.

The three regions are equally well marked among the Polyzoa of simpler organization than the *Phylactolæmata*, with the exception of the genera *Urnatella* and *Pedicellina*. The two latter have all three regions consolidated in one, and there may be said to be but two systems in their structure, the cœncœcial and lophophoric, the evaginatory having entirely disappeared, and the alimentary canal and reproductive organs occupying the cœncœcial region together.

The exceeding simplicity of the alimentary canal, the approximation of the mouth and anus, especially in *Urnatella*, where, according to the unpublished plates of Dr. Leidy (Pl. 15, fig. 5), they are so close together, that they are separated only by their own membranes which are continuous with each other, so that the intestine and œsophagus in the young seem to have but one common aperture through the disk (Pl. 15, fig. 6); the absence of the gastric cœcum of the *Phylactolæmata*, of the pointed œsophagal valve, and of the evaginable tube are all characteristics, that not only separate these two genera from the *Phylactolæmata*, but show them to be the very lowest of the Polyzoa.

The lophophore is withdrawn within the cell, and the invaginated fold forms in both genera a net between the tentacles, resembling the calyx of the *Phylactolæmata*, to which the lower part of the tentacles are soldered on its

inner side, and its upper free border forms the true aperture of the coenocelial cell. This is shown by the position of the sphincter muscle and its action in closing the cell, by drawing together the upper edge of the calyx-like fold and including the free ends of the tentacles which have been previously bent inwards and doubled upon themselves.* Thus not only does the so-called calyx homologize in position with the invaginated fold of the higher Polyzoa, but it closely resembles that organ in function, with the exception, however, of performing the office of a sheath for the invaginated tentacles in the absence of any evaginable tube. Both Urnatella and Pedicellina are invaginated zooids, and as such cannot be associated with those forms of Polyzoa which have the three regions of the body fully differentiated. The lophophore is permanently held attached to the inferior edge of the evaginated fold, and cannot be extruded from the cell, the superior portions of the tentacles being the only parts freely evaginated. I am aware that Pedicellina is said to possess an epistome and two arms by Prof. Allman, but these characters will hardly weigh against the absence of the tubular endocyst, which is common to all the Polyzoa from the Cheilostomata to the Phylactolæmata, the absence of a funiculus, and the simple character of the whole organization. Their appearance, also, is more suggestive of the Radiata than other Polyzoa, especially Urnatella, and the peculiarity of permanent invagination is shared equally with the young of the Phylactolæmata, whose lophophores at an early age are permanently invaginated and joined with the parietes of the cell, and are unfurnished with oesophageal valves. Embryology, therefore, as well as their general structure, justifies the position assigned to them, as the lowest types of the Polyzoa.

The concentration of the three regions is towards the anterior end of the Polyzoön, and if I am right in my estimation, this is a low feature. The evagination of the Perigastric and neural systems among the Cheilostomata,

* This is most clearly shown by several of Dr. Leidy's figures in which the tentacles are withdrawn as described.

and Cyclostomata and the Phylactolæmata, show that throughout all the modifications of succeeding and more complicated genera, the class as a whole retains the neural system at the posterior pole.

Although cephalization, as shown by Mr. Morse, is the tendency of the Saccata as a whole, still it must be admitted, that it is not the tendency of the lowest class, but, on the contrary, this class betrays throughout an anti-cephalic character.

From the intensely cephalized Urnatella and Pedicellina we have no cephalized forms until we reach Pedicellina. This, with its two invaginated folds, is a more cephalized type than Fredericella, which in its turn is more invaginated, and therefore more cephalized than the higher forms of Plumatella, such as *P. vitrea*. Lophopus and Pectinatella lead us gradually to Cristatella, which is as completely evaginated as any of the Ctenostomata or Cyclostomata. Thus, it is clearly shown that the differentiation of the three regions of the body by the elevation of the neural region to the posterior pole is the governing tendency of the organic changes of the class.

DESCRIPTION OF SPECIES.

The measurements were computed by a micrometer set in Tolles' B orthoscopic eye-piece with a 2 inch objective, and are given in decimal parts of a "millimètre," and also in equal numbers. The equal numbers roughly computed are each equivalent to $\frac{3}{32}$ m. m. or $\frac{1}{16}$ inch, according as they are measured upon the French scale, or an English steel ruler. The statoblasts are drawn upon the enlarged scale of $\frac{3}{32}$ m. m. or $\frac{1}{16}$ inch to $\frac{1}{8}$ of an inch, and consequently the figures give the relative sizes. The annuli were measured on either side, and the results are contrasted by placing the widths on the upper and lower side of a dividing line. The figures of the statoblasts being drawn upon the same scale, the different varieties of the same

species, as well as in the different species and genera, may be seen by comparing them. Those figured in the plates are not sufficiently accurate.

FREDERICELLIDÆ.

Cœnocœcium attached, dendritic. Lophophore oval. Statoblasts bare and smooth.

FREDERICELLA.

Cœnocœcium composed of elongated cells covered by a thin ectocyst. Invaginated fold broad, with numerous rows of posterior retentor muscles. Posterior attachment of œsophageal retractors solid.

FREDERICELLA WALCOTTII Hyatt.

This species differs from all others of the same genus in its peculiar mode of growth. The main branches are closely attached to the surface, and the free parts of the cells or branches rise abruptly from them. The former are long single stems, growing at acute angles, and often crossing each other.

There are two well-marked varieties, *a* and *b*.

All the branches of variety *a* were single and closely attached throughout, the only free parts were the upper portions of the cells. These might be of extreme length or quite short, the attached part varying between 12 m. m. and 5 m. m. the free portions between 6 m. m. and 1 m. m. The constant attachment and rarity of the branches, together with the length of the attached part, gives them the aspect of true stolons, the free portions of the cells appearing like individual zooids (Pl. 15, fig. 2). The branches of variety *b* still have the stolon-like aspect of variety *a*, but the deep channels in the surface of the wood prevent them from crossing each other to any great extent. The free portions of the cells also frequently branch, and the growth is then more dense than in variety *a*. Statoblasts were not observed.

Locality, Georgetown, Mass.

Remarks. The cœncœcia cover large areas, differing in this respect from all the other *Fredericellæ*, whose colonies when upon a flat surface are never very diffuse.

The more open growth, or variety *a*, was found in a shallower and more rapid part of the stream than variety *b*. Their peculiarities fit them for these different situations. Variety *a* exposes only its single cell to the action of the swift current, the remainder being firmly fastened, while variety *b*, not being in danger from the current, indulges in a freer and more dendritic growth.

I have taken the liberty of dedicating this species to Miss Elizabeth Walcott, of Salem, in whose agreeable society I had the pleasure of discovering it, during a field meeting of the Essex Institute.

FREDERICELLA PULCHERRIMA Hyatt.

Cœncœcia radiating more distinctly than in any other species, resembling in this respect *Plumatella*. Branches colorless, generally attached throughout; the free portions of the cells occasionally subdividing into free branches. Polypides do not differ sensibly from those of *Fredericella regina*. Statoblasts measure about .5 m. m. long, by about .16 m. m. broad (Pl. 15, fig. 3).

Remarks. The only locality is White's Bridge, at the outlet of Lake Sebago, Maine. The colonies upon the bark of branches near the shore were young, and had not yet attained their growth, but it is probable that the adults upon such surfaces are never so symmetrical as those upon the stems of the water-lilies.

FREDERICELLA REGINA Leidy, Mss.

The cœncœcia are scarcely describable in general terms, since they display almost all kinds of growth; but there are three principal varieties.

Variety a, Pl. 7, fig. 1. The colonies are not very large, but the branches are numerous. The attached parts of the cells are very long, but the free portions mere

nubs thickly strewn upon the branches. This variety occurs only where the surfaces are sufficiently large and smooth. Found only at Gorham, Maine.

Variety b, Pl. 7, figs. 2 and 3. The main branches are not necessarily attached, but grow in clumps, the colony often being attached by only a portion of the branch, and the free portions of the cells long. This occurs only on wide surfaces.

Variety c, Pl. 15, fig. 4, is an extremely dense growth, the branches are so crowded that in some instances they become adherent. The refuse matter in the current is deposited between them, and the whole appear to be adherent, resembling the Alcyonelloid variety of *Plumatella* so closely, that at first sight they might be mistaken for the same. This variety is found only upon limited surfaces or small twigs.

The polypide has from 18 to 22 tentacles. The intestine in some specimens has a faint, pinkish color. The statoblasts range all the way from .166 m. m. in breadth by .366 m. m. in length, to an almost orbicular outline which is .299 m. m. in breadth by .316 m. m. in length. In equal numbers they range as follows, from 5 by 11 to 5 by 12, from 6 by 11 to 6 by 14, from 7 by 10 to 7 by 13; and, finally, one specimen was 9 by 9½. Thus, there is a gradual increase in the proportional breadth from 5 to 7, while the length fluctuates between 10 and 14 without regard to the breadth.

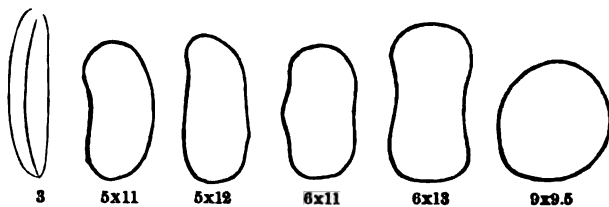


FIG. 13, statoblasts are all, with one exception, taken from one spot in a branch of a colony from Fresh Pond, Mass. The figures underneath give the proportions of the breadth to the length, except under the side view where they give only the breadth. This side view is taken from a specimen found in Mystic Pond, and is the longest I have seen, measuring .468 m. m.

Remarks. The extensive distribution of this species from Norway, Me., to Baltimore, Md., would prepare us

to meet with extraordinary power of adapting its organization to the different circumstances under which it might be placed, and it does afford a happy illustration of this principle. The colonies inhabiting a small brook near Gorham, Me. (Young's Brook), has all three varieties. The upper part of this stream where it is comparatively narrow and deep and where the supports for the colonies are generally rounded twigs, contains almost exclusively variety *c*, and occasionally variety *a*, wherever the surface is sufficiently extensive. Farther on, as the stream broadens and the current is less swift, variety *b* makes its appearance, and is the preponderating form. The other waters in which this species has been observed, namely, Pennissewassee Pond, Norway, Me. ; Fresh Pond, Cambridge, Mass. ; Schuylkill River at Philadelphia ; and Gwinn's Falls, Baltimore, Md., are comparatively still, and contained but one variety, variety *b*, the same that occurs in the more sheltered spots of Young's Brook.

The colonies of variety *b* rarely attain any considerable size, while in variety *c* they sometimes form thick clusters one or two inches in depth by three or four in length. Besides these three varieties, there is another probably belonging to this species, found in the outlet of Great Pond. The colonies are small, consisting only of a very few polypides. The brook formerly emptied a large fresh-water pond ; but this has been drained, and now at high tide the water becomes quite brackish, which probably accounts for the diminutive size of the colonies.

PLUMATELLIDÆ.

Cœncœcium attached, branching. Lophopus with two arms, standing out like the arms of a horse-shoe. Statoblasts annulated and spiny, the spines passing through the annulus.

PLUMATELLA.

Cœncœcium, with shorter cells than in *Fredericella*, covered by the thin ectocyst. Invaginated fold broad,

with numerous rows of posterior retentor muscles. Statoblasts with plain annulus, and rounded extremities.

PLUMATELLA DIFFUSA Leidy.

I found this species abundant in the ponds and brooks near Cambridge and Baltimore. Those which inhabited the brooks differed greatly from the pond varieties. The first, or variety *a*, has distinct cells, with tough, brown ectocyst, and the branches diffuse, and rarely adherent (Pl. 8, figs. 11, 12, 13). The pond varieties, or variety *b*, were much denser growths; the branches generally adherent, the ectocyst colorless, and, in several specimens from Mystic Pond (living in brackish water, associated with *Cordylophora*), the branches were so closely packed that the colonies formed thin, gelatinous sheets of considerable extent, in which no branches could be traced from above. The cells also had the hexagonal outline usually ascribed to *Alcyonella*, and their lower portions were more or less merged in the branch.

The brook variety, or variety *a*, was generally keeled and channelled, but this was an exceedingly variable character. Polypide was not examined.

Statoblasts vary from .199 m. m. in breadth by .333 in length, to .249 in breadth by .349 in length. In equal numbers they vary from 6 by 10 to 6 by 12, 6.5 by 11.5, and 7.5 by 10.5.

Here, again, as in other species, the transverse diameter is increased steadily, while the longitudinal fluctuates between 10 and 12. Annulus varies between $\frac{3}{4}$ and $\frac{2.5}{4}$ at the ends, and between $\frac{1.5}{2.5}$ and $\frac{1.5}{1.5}$ at the sides.

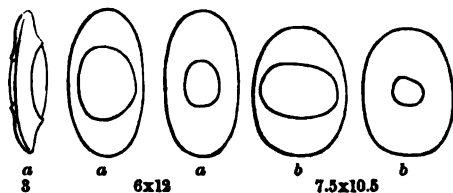


FIG. 14, *a*, *a*, *a*, side, front, and back views of one specimen; *b*, *b*, front and back views of another, all from Mystic Pond, Mass.

PLUMATELLA ARETHUSA Hyatt.

The coenecia have the usual range of variation. Variety *a* has distinct cells and radiating branches. The ectocyst may be either brown or colorless, and the cells vary greatly in size (Pl. 8, figs. 1, 2).

Variety *b* has the branches and cells adherent, forming thick encrustations upon the surfaces of branches or logs; the cells, however, appear to be distinct, the lower portion not being obliterated to so great an extent as in variety *c* of *P. vesicularis* and variety *b* of *P. diffusa*. Variety *a* has generally a brownish ectocyst, but the younger colonies or branches are colorless. Orifices are channelled in the brown colonies, and entire in the colorless ones. The posterior retentors consist of from 7 to 13 rows, and the anterior retentors have about 10 bands. Tentacles from 40 to 60 in number. Statoblasts vary from .199 m. m. in breadth by .266 m. m. in length, to .266 in breadth by .399 m. m. in length. In equal numbers the statoblasts measure 6 by 8, $6\frac{1}{2}$ by 9, $6\frac{1}{2}$ by 10, 7 by 9 to 7 by $11\frac{1}{2}$, 8 by 11 to 8 by 12.

There is, therefore, as in the preceding species, a gradual increase in the breadth, and also a gradual increase in length among the full-grown statoblasts.

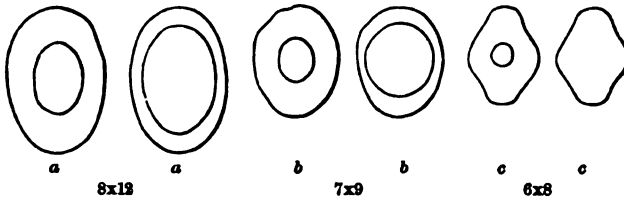


FIG. 15, three varieties of the statoblast; *a, a*, back and front view of one specimen; *b, b*, back and front view of one specimen; *c, c*, back and front view of one specimen. In this specimen the annulus covers the whole side of the statoblast on one side.

Localities. Pennissewassee Pond at Norway, Gorham, Great Falls, the outlet of Great Pond on Cape Elizabeth, Presumpscot River, all in Maine; Fresh Pond and Mystic Pond at Cambridge, and Green River at Greenfield, all in Massachusetts.

Remarks. I have collected variety *a* generally upon broad surfaces in moderate currents or still water; but

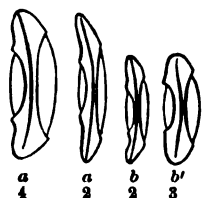


FIG. 16, four varieties of the statoblast seen from the side. The outlines correspond to those with similar letters in fig. 15, but their thickness is represented by the numbers below. In both figures *a, a*, are from Mystic Pond; *b, b, c*, from Fresh Pond; *b'* from Pennissewassee Pond.

small colonies may occur upon twigs and roots. In Tommy's Brook, variety *b* is associated with variety *c* of *F. regina*; while farther down the brook, variety *a* is found in company with variety *b* of that species. It is evident here that the Alcyonelloid varieties of both species are due to the action of the limited areas of growth and extraordinary development of the reproductive powers.

The specimens found in the brackish water of the outlet of Great Pond are small colonies agreeing in general character with the small-sized *Fredericellæ*, also found there. Those in Mystic Pond belonged to variety *b*, agreeing in all respects with the specimen of *P. vesicularis*, *diffusa*, and *vitrea*, found together near the outlet of the lower pond. Those from Fresh Pond belonged to variety *a*, and were associated with variety *a*, *F. regina*, variety *b*, *P. vitrea*, and variety *a*, *P. vesicularis*. The general character assumed by the different species leads at once to the supposition, as the only reasonable inference, that these varieties are the results of the association of the different species under the action of similar physical causes.

PLUMATELLA VITREA Hyatt.

The cœncœcia of this species are covered by colorless gelatinous ectocysts, rather thicker than in any other of the *Plumatellæ*, except the Alcyonelloid variety of *P. diffusa*.

Variety *a* has radiatory branches, and the cells are more distinct than in variety *b*; but the lower portions are merged in the common branch more than in the diffuse form of *P. vesicularis* or *diffusa*. When contracted, the cells are quite distinct and prominent. It is common

upon small sticks and twigs in the fresh water of Mystic Pond.*

Variety *b* grows in long lines—rarely branching—upon the surfaces of boards, and invariably solitary; the polypides arranged sometimes in one row, but oftener in clumps of from two to twenty heads, of all sizes (Pl. 9, figs. 1, 2). The lower portions of the cells are merged in the main branch, the breadth of the invaginated fold, when the polypide is fully expanded, is less, and the polypide can be more fully evaginated than in any other species (vide Pl. 9, fig. 3.) When contracted, the cells project but slightly above the branch. Viewed from above, a branch is very like the variety of *P. vesicularis* depicted in figure 18. It has been found only in Fresh Pond.

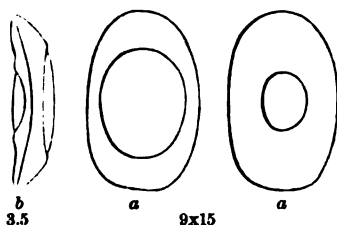


FIG. 17, *a*, *a*, front and back views of same specimen from Mystic Pond; *b*, side view of another individual from Fresh Pond.

Variety *c* occurs upon flat pieces of tin and other broad surfaces in the brackish waters of Mystic Pond. The colonies differ from those of variety *b* in their diffuse and closely crowded branches, forming a dense gelatinous carpet. The statoblasts measured between .266 m. m. by .366 m. m., and .383 by .566 m. m. In equal parts from 8 by 11 to 9 by 15, and 10 by 16 to 11 by 15, 11 by 16 to 11½ by 16, and 11½ by 17. The annulus from ⅔ at the ends and ¾ at the sides, to ¾ at the ends and ⅔ at the sides. Found only in Mystic and Fresh Ponds, Cambridge, Mass.

PLUMATELLA VESICULARIS Leidy.†

This species, previously described from the neighbor-

* This Pond is divided by a dam so that the upper portion is wholly filled with fresh water, while the salt tide enters the lower part, rendering it quite brackish.

† Proceedings Philadelphia Academy Natural Sciences, vol. 7, p. 192.

hood of Philadelphia by Dr. Leidy, is found also near Cambridge, Mass., and in Sebago Lake, Maine.

The colonies differ considerably. Variety *a*, found upon smooth boards in Spy Pond near Cambridge, is very large when full grown, the branches often crowded, but never adherent, the cells distinct. The branches, however, of variety *b*, upon rougher boards, where the decaying surface

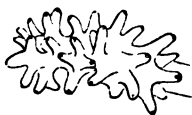


FIG. 18.

was deeply grooved, grew in these channels, and were neither so radiatory or closely crowded. These are only accidental varieties, which do not differ essentially in structure; but at White's Bridge, Sebago Lake, Maine, I found upon the same colony an interesting structural variation from the usual mode of building out the branches. The tip of a branch (Fig. 18), either in consequence of some impediment upon the surface, or from a sudden and excessive development of the vital energies, began to produce three buds at a time instead of one, thus giving to the branch a lobiform aspect corresponding with the characters of variety *b* of *Plumatella vitrea*.

This species may therefore be assumed to be capable of two important variations, one in which the cells are distinct, and one (variety *c*) in which they are partly merged in the branch. The ectocyst is not constantly colorless, but may be brown in some localities.

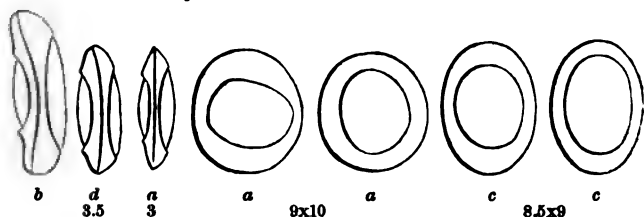


FIG. 19. *a*, *a*, *a*, front, back, and side views of one statoblast; *c*, *c*, front and back views of another specimen, both from Beaver Pond, near Cambridge, Mass.; *d*, from Spy Pond, near same place; *b*, from Sebago Lake, Maine, is inaccurate, should be but little longer than *d*, and about the same thickness.

The anal extremity of the intestine is rather lower than in *P. Arethusa*, and the gastric cœcum is very blunt. Posterior retentors are about eight rows, and the anterior retentors about ten or twelve bands; tentacles, fifty to

sixty. The statoblasts vary between .199 m. m. in breadth by .333 m. m. in length; .233 m. m. in breadth by .349 m. m. in length. The proportions are in equal parts from 6 by 10 to 6 by 12, $6\frac{1}{2}$ by $11\frac{1}{2}$, and $7\frac{1}{2}$ by $10\frac{1}{2}$; annulus varies from $\frac{2}{3}$ at the sides to $\frac{1}{2}$ at the sides and $\frac{1}{3}$ at the ends.

PECTINATELLA.

Cœnœcium without cells, the branches being large lobes with the polypides on the upper side; naked above, with the ectocyst gathered below into a thick common base for the colonies. Invaginated fold almost obsolete. Statoblasts with spinous annuli, extremities rounded.

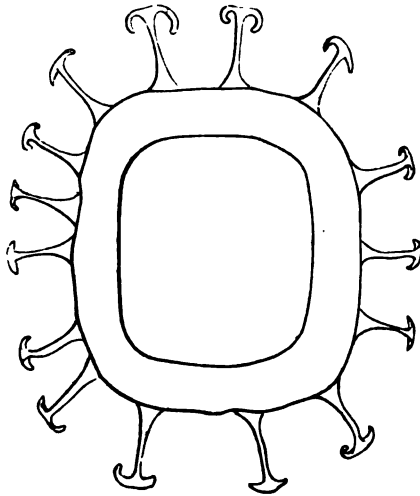
PECTINATELLA MAGNIFICA.

The polypides are arranged on the lobes; sometimes in single, but generally in double rows, placed alternately.

The ectocyst is of great thickness at the centre, and may be from four to eight inches in depth; arms about as long as the evaginable tube of the polypide.

Tentacles number from sixty to eighty-four. Lower part of these and the mouth parts are crimson.

Statoblasts vary from .8 m. m. in breadth to .9 m. m. in length. The proportions in equal numbers are as follows: 24 by 27, or 26 by 27, 27 by 28, 28 by 29, 29 by 30, 30 by 30.



24x37

FIG. 20, from Mystic Pond, near Cambridge, Mass. Although usually the annulus on the lower side presents a broader surface, as in Pl. 10, Figs. 3 and 4; this is often so narrow that when measured from above there is no appreciable difference. [The lateral view of the statoblast in Pl. 10 is correct, and therefore not given here.]

Annulus varies from $\frac{3}{4}$ to $\frac{1}{2}$ at the sides, and from $\frac{3}{4}$ to $\frac{1}{2}$ at the ends. The spines are about .233 in length, measuring from the exterior of the annulus outward.

The specimens found in Fresh Pond, Mass., and those occurring in Pennissewassee Pond, Maine, differ in the number of tentacles and spines. The former have from sixty to seventy-five tentacles, and the statoblasts from twelve to seventeen spines, while the latter have from seventy-two to eighty-four tentacles, and from twenty to twenty-two spines. The varieties of form in the masses are due wholly to the contour of the surfaces upon which they grow. If these be flat the mass becomes sub-conical; if around a twig, spindle-shaped; on the end of a short projecting stump of a branch, a rotund mass, as in Pl. 9, fig. 4.

When the ectocyst decays, as previously remarked, in old age, most of the colonies either dying or floating off becomes attached and live for some time isolated, but do not increase in size; some, however, continue to live more or less widely separated upon the remains of the ectocyst, but in consequence of the removal of the lateral pressure from surrounding colonies, lose their sub-angular hexagonal form.

The polypides are found only upon the outer portions of the lobes in the colonies, the inner surface being left bare, spotted however with yellowish and opaque white blotches, the remains of the tentacles and gemmæ of dead polypides in different stages of absorption.

In this process of absorption of dead polypides the stomachs disappear first, the tentacles next, the gemmæ last. The persistence of the latter is interesting, because they vanish in the living *Plumatellæ* and *Fredericellæ* soon after the breeding season of early spring is passed. The large size of the albuminous envelope of the winter buds, very seriously incommodes freedom of motion, in the muscles of living polypides, and presses the stomachs out of place. The statoblasts are largest and most crowded near the centre, where the polypides first die out. These circumstances would imply that the growth of the gelatinous covering was not only a matrix for the hooklets, but served—in part at least—to accomplish the death of

the inner lines of polypides. This is probably not the case, however, for colonies which have but few statoblasts show as many dead polypides internally as the others. It seems to depend wholly upon the age of the polypides.

Specimens may be very roughly handled before the polypides will retract, even lifting them out of the water has no lasting effect, they expand almost as soon as they are replaced. After being kept in confinement some weeks they become more fearful, and when alarmed will remain longer retracted, but even then seem to find it necessary to spread out the tentacles for air very soon after the annoyance ceases, although an hour will sometimes elapse before the rest is expanded.

CRISTATELLIDÆ.

Cœnœcium locomotive, entire, divided internally by muscular walls. The ectocyst a transient excretion from the endocyst. Invaginated fold obsolete. Statoblasts annulated and spinous, the spines passing outside of the annulus.

CRISTATELLA.

The generic characters not ascertained.

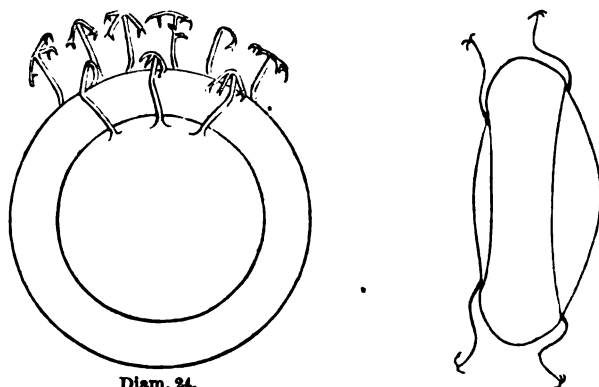
CRISTATELLA OPHIDIOIDEA.

Cœnœcium round in the young, but in the adult colonies is frequently about eight inches long by one-fourth of an inch broad; a specimen of this length always follows a sinuous course; the smaller cœnœcia sometimes proceed in straight lines, and one about an inch long crawling in this way, will progress its own length in twenty-four hours.

Adult polypides are in two rows, the tentacles of the third row are not fully developed on the extremities of the arms, and from the latter outwards, all stages of growth are represented in the lines of buds and young polypides, varying from two to five.

The lophophore is as long as the perigastric tube when fully expanded, and bears about ninety tentacles.

The statoblasts are orbicular and fringed with from twenty to twenty-two short, and thirty-two to thirty-seven long hooklets with forked points, making from one to six points to each hooklet. Diameters vary from .8 m. m. to .83. In equal parts from 24 to 25. Annulus varies from $\frac{1}{2}$ to $\frac{1}{4}$.



Diam. 24.

FIG. 31, statoblast from Pennissewassee Pond, Maine. The spines are drawn from various specimens to show the range of variation.

Remarks. This species was found upon the under side of snags or flat-boards in settlements, underlaid by the common ectocyst as in *Pectinatella*. This is an even sheet, perhaps in large settlements one-eighth of an inch in thickness.

The statoblasts are few in number and differ materially from those figured by Professor Allman of *C. mucedo*. The outer edge of the annulus is entire and not scalloped as in the last named, and the brown sheath of the statoblast is smooth and not covered by minute bosses as in *C. mucedo*; the outline of the statoblast in our species, when seen from the side, is also much less symmetrical.

Cristatella Idæ, described by Dr. Leidy, is only about one and three-fourths of an inch in length, and has only seventy-two tentacles, and a statoblast with about seventy spines.

EXPLANATION OF SIGNS USED IN THE PLATES.

A	Cœnœcium.	L'	Brachial Contractors.
A'	Cœnœcial Trunk.	M	Gastric Retractors.
A''	Cœnœcial Branches, lobes or tubes.	M'	Œsophageal Retractors.
A'''	Cœnœcial Cells.	M''	Bracial Retractors.
A''''	Cœnœcial Orifice.	M*	Common trunk of the Retractors.
B	Invaginated Fold.	M̄	Lophophoric Flexor.
C	Polypide.	N	Anterior Retentors.
C'	Dead Polypide.	N'	Posterior “
D	Ectocyst.	O	Outer Tentacular Bands.
E	Endocyst.	O'	Inner “ “
E'	First layer of the Endocyst.	P	Median muscle of the Epistome.
E''	Second layer of the Endocyst.	P'	Lateral muscle of the Epistome.
E'''	Third “ “ “	Q	Cœnœcial walls of Cristatella.
E''''	Fourth “ “ “	R	Parietal fibres (probably abnormal).
F	Brachial Collar.	S	Nerve-mass.
F'	Neural Partition or diaphragm	S'	Lateral ganglions.
G	Calyx.	T	Lophophoric nerve-trunks.
H	Tentacles.	T'	Epistomic “ “
H'	Tubular interior of the Tentacles.	T''	Brachial “ “
H''	Cilia.	T'''	Polypidal “ “
I	Lophophore.	T''''	Œsophageal “ “
I'	Epistome.	T	Gastric “ “
I''	Mouth.	T†	Intestinal “ “
J'	First layer of the Alimentary Canal.	U	Lophophoric “ branches.
J''	Second layer of the Alimentary Canal.	U'	Tentacular “ “
J'''	Third layer of the Alimentary Canal.	V	Funiculus.
J''''	Fourth layer of the Alimentary Canal.	W	Free Statoblasts.
J̄	Hepatic Folds.	W'	Horny Casing, or brown sheath.
K	Œsophagus.	W''	Annular Sheath.
K'	Stomach.	W'''	Spines.
K''	Intestine.	W''''	Gelatinous Envelope.
K'''	Œsophageal Valve.	X	Fixed Statoblasts.
K''''	Intestinal “	Y	Buds.
K̄	Anus.	Y'	Young Polypides.
L	Sphincter Muscle.	Z	Clear spaces below the bases of the Tentacles.

EXPLANATION OF PLATE 15.*

FREDERICELLA REGINA Leidy.

Fig. 1. View of lophophore from above with the tentacles removed, showing the nerves. G, calyx; H, tentacles; I', epistome; I'', mouth; M', lophophoric flexor; U, lophophoric nerve-branches; U' tentacular nerve-branches.

Fig. 4. Alcyonelloid variety from Tommy's Brook, Gorham, Maine. The appearance of the surface of the colony is shown on the left of the figure, the branches having been all removed in front in order to exhibit the arrangement of the branches and their connection with the wooden stem around which they grew.

FREDERICELLA WALCOTTI Hyatt.

Fig. 2. Variety *a*, Georgetown, Massachusetts.

FREDERICELLA PULCHERRIMA Hyatt.

Fig. 3. Sebago Lake, Maine.

URNATELLA GRACILIS Leidy.

Figs. 5, 6. Diagrams of figures from one of Dr. Leidy's unpublished lithographic plates, showing the approximation of the mouth and anus. I'', mouth; K', stomach; K'', intestine; K̄, anus. Fig. 6 is a bud and exhibits the relation of these parts in the young.

* This plate was originally intended to accompany the others in Vol. IV, but was unavoidably delayed; and as it is referred to in the text as "Plate 15," that number has been retained on the plate in order to avoid confusion. — EDITOR.

XI. *Flora of the Hawaiian Islands.*

BY HORACE MANN.

[Continued from page 192.]

maturity. Seeds oval, somewhat compressed, chesnut-colored. Var. **GLABRATA**: under surface of the leaves less pubescent or nearly glabrous, as also the calyx. Flowers sometimes smaller.

Common on sides of the high mountains, and often at an inconsiderable elevation.

17. **CÆSALPINIA** Linn.

Sepals 5, shortly united at the base, the lower one rather larger and concave. Petals 5, imbricated, rather unequal, the upper inner one the smallest, the two lowest outer ones the largest. Stamens 10, free, all fertile; the filaments hairy. Anthers ovate. Ovary with 2 or more ovules; style cylindrical, rarely thickened at the apex, stigma minute or concave and terminal. Pod ovate, oblong, or lanceolate and falcate, flattened, without wings, coriaceous, 2-valved, or nearly indehiscent. Seeds ovate, orbicular, or globular, with a hard testa; albumen none. — Trees or shrubs, which are sometimes high climbers, unarmed or with recurved prickles. Leaves bipinnate, leaflets small and many or few, or larger, herbaceous or coriaceous. Stipules various. Flowers yellow or red, often very showy, in axillary racemes, or the racemes terminal and paniced. Bracts small or rarely large and membranaceous, usually very caducous.

§ 1. **GUILANDINA**. Climbing or spreading prickly shrubs. Pod oval-orbicular, turgid, with hooked spines. Seeds globose.

§ 2. **CÆSALPINIA** proper. Trees or rarely shrubs, unarmed. Leaflets numerous. Pod oblong or lanceolate, smooth. Seeds flattened.

A considerable genus, found in hot parts of the globe.

C. (**GUILANDINA**) **BONDUC** Benth. (*Enum. No. 119.*) A more or less climbing and spreading shrub, 3°-10° high, or more, armed with hooked prickles. Leaves 1° or more long. Leaflets ovate, obtuse or acute, rounded at the base, on short petioles, smooth on both sides, somewhat shining above, 1½' - 2½' long, 1' or more wide. Peduncles short, stout, puberulent or finely tomentose, as also the pedicels and calyx. Pedicels ½' long, about the length of the calyx, which is divided nearly to the base, the lobes oblong and acute. Petals nearly equal, hardly longer than calyx, yellow. Stamens joined in a ring at the base. Ovary tomentose, few-ovuled. Pod at maturity nearly orbicular stipitate 1½'-2' in diameter, tipped with the persistent style, and both valves closely covered with straight or curved spines 2''-3'' long.

Common on the borders of woods in many places. Native name, "Kakalaloa."

2. **C. KAVAIENSIS** H. Mann. (*Enum. No. 120.*) A small tree, with
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dark-colored and almost indestructible wood; the young branches, &c., pubescent and unarmed. Leaflets 3-5 on each pinnule, oblong, obtuse or emarginate, obtuse or tapering at the base, short petioled, glabrous excepting the base of the midrib below, and paler beneath, 2' long, $\frac{1}{4}$ '- $\frac{3}{4}$ ' wide. Racemes many-flowered. Flowers purple, $\frac{1}{4}$ ' long, on pedicels of twice their length. Calyx nearly as long as the petals, glabrous. Stamens scarcely exerted. Pod unknown.

On the leeward verge of Kaul, whence it was brought me by a native at the instigation of my good friend *Mr. Valdemar Knudsen*. An interesting species, the fruit of which is much desired to make certain its proper relationship. Referred at present to this section of the genus as most probably the one to which it belongs. Native name, "Uhihihi."

Poinciana pulcherrima Swartz, the so-called Pride-of-Barbadoes, is often cultivated or its very showy red and yellow flowers.

18. CASSIA Linn.

Sepals 5, somewhat unequal, scarcely connected at the base. Petals 5, usually unequal, spreading. Stamens usually 10, either all equal and fertile, or the upper ones small and sterile, with 2 or more of the lower fertile ones much larger. Anthers, when fertile, opening at the end only, in pores or short slits. Ovary with several ovules. Pod cylindrical or flattened, usually long, but variously shaped. Seeds usually oblong and transverse, sometimes parallel with the valves, with a small quantity of albumen. Radicle short and straight. Herbs, shrubs, or trees. Leaves abruptly pinnate, the leaflets opposite.

A large genus, widely distributed within the tropics, but particularly numerous in Central and South America.

1. *C. GAUDICHAUDII* Hook. & Arn. (*Enum. No. 121.*) A shrub 8°-10° high; young branches, petioles, peduncles, &c., puberulent. Leaflets 3-5 pairs, oblong, obtuse or somewhat tapering at both ends, usually retuse at the apex, $\frac{1}{4}$ '-2 $\frac{1}{2}$ ' long, $\frac{1}{4}$ '- $\frac{3}{4}$ ' wide, soon glabrate or quite glabrous on the upper surface, and shining; when reduced to three pairs, the gland is at some distance below the lower pair, on the petiole, instead of between them. Bracts, pedicels, and calyx puberulent. Pedicels about 6" long. Calyx 2"-3" long, the lobes ovate and acute. Petals not much exceeding the calyx in length, yellow. Ovary tomentose. Pod linear, very flat, 1 $\frac{1}{4}$ '-4 $\frac{1}{4}$ ' long, $\frac{1}{4}$ ' wide or less, somewhat stipitate, nearly or quite glabrous when grown. Seeds 3-10, flat, nearly orbicular, blackish.

In open woods, not uncommon throughout the group.

2. *C. OCCIDENTALIS* Linn. An erect glabrous annual, 3°-5° high, sometimes hard at the base so as to appear woody. Leaflets 4-6 pairs, ovate-lanceolate or lanceolate, acuminate, ciliate, on the margins, 1'-2' or in thrifty plants 3' long, with an ovate gland on the petiole near the base. Racemes terminal, short and few-flowered, with

occasionally a few flowers on short pedicels in the upper axils. Flowers yellow, 6" long. Two of the anthers large, oblong, 4 or 5 others like them, but smaller, the three uppermost small and sterile. Pod linear, slightly curved, 3'-5' long, about 3" broad, at first flat with the edges thickened, but becoming at length nearly as thick as broad.

Becoming rather common in waste places. Widely dispersed, as a weed, over the warmer regions of the globe, especially in America and Africa.

One or more species of *Bauhinia* (which belongs to this suborder, and is known by having but a single leaflet, deeply lobed at the summit, or sometimes almost divided), are a good deal cultivated for their very showy flowers.

19. MIMOSA Linn.

Sepals 3, 4, 5, or 6, usually minute, free or shortly united. Petals of the same number, more or less united, valvate. Stamens equalling the petals in number, or usually twice as many, free, exserted. Ovary sessile or rarely stipitate, 2-many ovuled; style filiform. Pod oblong or linear, usually flattened, 2-valved, continuous or jointed. Seeds ovate or orbicular, flat.—Herbs or shrubs, rarely tall climbers or trees, armed or unarmed. Leaves bipinnate, usually sensitive, or rarely none and the petiole phyllodious. Heads on axillary peduncles. Flowers small.

A large genus, especially abundant in the warm parts of America, but also distributed throughout the tropics.

1. *M. PUDICA* Linn. Stem herbaceous or suffrutescent, spreading, one to several feet long, hairy or glabrate, armed with infrastipular and scattered prickles. Pinnæ usually two pairs, about as long as the petiole. Pinnules 15-25 pairs, oblong-linear, pointed, ciliate with appressed bristles, glabrescent, 3"-6" long. Flowers heads ovoid. Calyx abortive. Pod oblong, sinuate, 2-5-seeded; valves jointed, glabrous, unarmed; border armed with spreading prickles.

In waste places, open fields, &c. Doubtless introduced. Common in most parts of the tropics as an introduced weed, though probably indigenous to Brazil. Known generally as the *Sensitive Plant*, on account of the leaves shutting up quickly when irritated.

20. ACACIA Willd. [Koa.]

Calyx teeth or lobes 3, 4, or 5, or entirely separate, or rarely almost obliterated. Petals of the same number, usually more or less joined, rarely none. Stamens indefinite, usually more than 50 (sometimes as many as 400), exserted, free or shortly joined at the base. Ovary sessile or stipitate, few-many ovuled; style filiform. Pod ovate-oblong or linear, straight, curved, or variously twisted, flat or nearly or quite terete, membranaceous, coriaceous, or ligneous, 2-valved or indehiscent, continuous within, or divided in various manners, rarely breaking up in joints. Seeds lying transversely or length-

wise, usually ovate, and compressed, sometimes arillate.—Trees, shrubs, or rarely herbs, unarmed, aculeate or spinose. Leaves bipinnate, leaflets often small, in many pairs, or the leaflets nearly or entirely wanting and the petioles dilated vertically and taking the place of the leaves (and called *phyllodia*). Petiolar glands often wanting. Stipules spinescent or inconspicuous, rarely membranaceous. Head of flowers globose or a cylindrical spike, on solitary or fascicled axillary peduncles, or paniced at the ends of the branches. Flowers small. Stamens yellow or white, rarely as long as half an inch. Bracts usually 2, connate, short and scale-like, either close under the head or in the middle or at the bottom of the peduncles.

A very large and diversified genus, found throughout the tropics, but more especially in Australia and Africa.

1. *A. KOA* Gray. (*Enum. No. 122.*) A large forest tree, entirely unarmed. Leaflets usually only appearing on young plants or shoots, when they are covered, in the growing parts, with a fine golden yellow silkiness. The phyllodia 3'-6' long, $\frac{1}{4}$ '-2' wide, either tapering at both ends, or very obtuse at the apex, with several strong longitudinal veins, coriaceous, quite glabrous. Flower heads on short axillary peduncles, 3 or 4 heads on each, yellow, not more than 3" in diameter, on pedicels about 4" long. Pod 3'-6' or more long, $\frac{1}{2}$ '-1' or more wide, quite flat, often a little constricted between the seeds.

Very common in parts, excepting very wet forest regions. Native name, "Koa;" the variety on the mountains with harder wood and broader phyllodia is called "Koaie."

2. *A. FARNESIANA* Willd. (*Enum. No. 123.*) A much branched shrub 6°-8° high, quite glabrous or slightly pubescent on the petioles and peduncles. Leaves of 3-6 or rarely eight pairs of pinnae. Leaflets 10-20 pairs on each pinna, linear, about 2" long. Stipules converted into slender straight thorns very variable in length, the plant otherwise unarmed. Peduncles usually 2 or 3 together in the older axils, each bearing a single globular head of yellow or whitish strong-scented flowers. Pod thick, irregularly cylindrical or fusiform, indehiscent, filled with a pithy substance, in the midst of which lie the seeds.

Very abundant in the region of the Salt Lake (*Alia pakai*) and Ewa, Oahu; also becoming naturalized in other places. Supposed to be of American origin, but formerly much planted and now naturalized in almost all warm countries.

ORDER XXV. ROSACEÆ.

Trees, shrubs, or herbs, with alternate (usually) stipulate leaves, and regular flowers. Calyx of 5 more or less united sepals, often with as many alternate bracts. Petals as many as the sepals (or rarely none), mostly imbricated in æstivation, and with the numerous, dis-

tinct stamens, perigynous. Ovaries with one, two, or few ovules. Albumen none. Embryo straight with large cotyledons.—The three suborders are distinguished as follows:—

AMYGDALÆÆ, has the solitary ovary free from the deciduous calyx, with two suspended ovules and a terminal style. • Trees or shrubs.—Here belong the peach and almond (species of *Amygdalus*), the Plum and cherry (species of *Prunus*), &c.

ROSACEÆ PROPER, in which the ovaries are numerous (or rarely few or solitary) and free from the calyx (which is often bracteolate as if double), but sometimes enclosed in its persistent tube,—in fruit becoming either follicles or achenia. Styles terminal or lateral. Herbs or shrubs.—The Rose (*Rosa*), Raspberry and Blackberry (*Rubus*), Strawberry (*Fragaria*), the *Spiræa* of the gardens, &c., belong here.

POMEÆ, with the two to five ovaries cohering with each other and with the thickened and fleshy or pulpy calyx-tube (thus the ovaries inferior); and each with one or two, or in the Quince several, ascending seeds,—is familiar in the Apple, Pear (*Pyrus*), &c., and is represented with us by *Osteomeles*.

Calyx free from the ovaries.

Petals 5. Stamens and carpels indefinite.

Calyx without bractlets. Fruits slipping off the dry receptacle as a thimble. Shrubs, 1. **RUBUS**.

Calyx with 5 bractlets, thus appearing 10-lobed. Fruits not separating from the juicy receptacle. Herbs, 2. **FRAGARIA**.

Petals none. Stamens 1-10 short. Carpels 1 or 2. Herbs with pinnate leaves, 3. **ACÆNA**.

Calyx cohering with the ovaries. Shrub, 4. **OSTEOMELES**.

1. **RUBUS** Linn. [Akala.]

Calyx free, deeply 5-lobed, persistent. Petals 5. Stamens numerous. Carpels numerous, with two pendulous ovules in each. Fruit a kind of granulated berry, formed by the union of the succulent carpels, round the conical or shortly oblong, dry receptacle.—Weak scrambling shrubs, or sometimes herbs, usually prickly. Leaves pinnately or palmately divided into distinct segments or leaflets, or rarely simply lobed. Flowers axillary, or in terminal leafy panicles.

A large genus, widely distributed over most every part of the globe.—In the Raspberry section of the genus the drupaceous fruits cohere with one another and come off the dry receptacle, which, on the contrary, in the Blackberry section, becomes juicy and does not separate from the fruits.

1. **R. HAWAIIENSIS** Gray. (*Enum. No. 123.*) A weak-stemmed shrub 10-15° high, the stems 1' or 2' in diameter at the base. The young branches, petioles, &c., tomentose-pubescent, flexuose, usually armed with small straight or hooked bristly prickles, at length glabrate. Stipules filiform or setaceous, 3''-4'' long. Leaves trifoliate. Leaflets ovate, acuminate or acute, obtuse or truncate at the base,

pinnatifid-incised or very deeply doubly-toothed, the teeth sharply pointed, membranaceous, pinnately veined, softly tomentose beneath, becoming glabrate, as is the upper surface; the terminal leaflet $2\frac{1}{2}$ ' - $3\frac{1}{2}$ ' long, $1\frac{1}{2}$ ' - $2\frac{1}{2}$ ' wide, the lateral leaflets shortly petiolulate and smaller; all occasionally subeordate. Peduncles 1 - 8-flowered, axillary or terminal, short; when branched the pedicels 1' or less in length. Calyx-tube sparingly setose-prickly and tomentose; the lobes $6\frac{1}{2}$ " - $8\frac{1}{2}$ " long, long pointed, and as long as the broadly-ovate, pink or red petals. Receptacle rather hairy. Fruit ovoid, $\frac{1}{2}$ ' - $1\frac{1}{2}$ ' long, red, but hardly edible, bitter. A variety is much less pubescent but otherwise the same.

Woods and Plains of Mauna Loa and Mauna Kea, Hawaii, where it is common. Kaul.

2. *R. MACRÆI* Gray. (*Enum. No. 124.*) A much branched and spreading, rather weak shrub, 5° - 6° high; young branches, &c., quite tomentose, and armed with slender prickles. Stipules subulate, rather large, sometimes almost setaceous. Stem leaves 3-foliate, those of the flowering branches smaller and 3-lobed. Leaflets roundish or ovate, obtuse or acute, $1\frac{1}{2}$ ' - $2\frac{1}{2}$ ' long, somewhat coriaceous, canescently-tomentose beneath, glabrate above; thickly doubly toothed, the teeth, though short and broad, mucronate; the lateral leaflets shortly, the terminal more decidedly, petiolulate, or rarely sessile. Peduncles axillary, quite prickly, 1-flowered, $1\frac{1}{2}$ ' - $2\frac{1}{2}$ ' or more long. Flowers $1\frac{1}{2}$ ' in diameter, red. Calyx-lobes very tomentose, not hispid-prickly, oblong, usually acute, $\frac{1}{2}$ ' long after flowering, the edges serrate from the middle to the apex. Petals obovate, often notched at the apex, as long as the calyx. Ovaries hirsute with hairs which persist on the ripe fruit, which is sweet and edible, $\frac{1}{2}$ ' or more in diameter.

Mauna Kea, Hawaii. Haleakala, East Maui, at an elevation of 6,000 feet, and thereabouts.

2. *FRAGARIA* Linn. [*Ohelo papa.*]

Calyx 5-cleft, with 5 persistent bractlets, making it look as if 10-cleft. Petals 5. Stamens indefinite. Carpels indefinite, on a convex receptacle; style ventral, short, persistent. Ovule solitary. Achenia indefinite, minute, often sunk in the receptacle, and at length deciduous, dry, and hard. Seed ascending. — Perennial herbs, usually stoloniferous, sericeous or villose, or rarely glabrous. Leaves 3-foliate. Stipules membranaceous, sheathing. Scapes erect, few-flowered. Flowers white, rarely yellow, nodding or somewhat erect, polygamodioecious.

A small genus, but the species widely distributed over the temperate regions, and in the mountains of the tropics in places.

1. *F. CHILENSIS* Ehrh. (*Enum. No. 125.*) A perennial herb from a thickened stock; very silky-pubescent. Leaves on petioles $2\frac{1}{2}$ ' - $6\frac{1}{2}$ ' long.

Leaflets roundish or ovate, cuneate at the base, glabrate or glabrous above, coriaceous. Scape about the length of the leaves, somewhat umbellately few-flowered. Flowers on pedicels 1'-2' long, from a many bracted base. Fruit (which is the soft receptacle, in or upon which the true fruits (achenia) are situated) $\frac{1}{2}$ '-1' long, edible.

The *Strawberry* seems to be best satisfied with a high mountain climate; abundant on Hualalai, Manna Kea, Haleakala, &c., at an elevation of 4,000°-8,000°. Also from Chili and on the coast of California and Oregon.

3. ACÆNA Linn.

Calyx-tube persistent, variously shaped, naked or armed with spreading spines, constricted in the throat, 3-7 lobed; the lobes valvate. Petals none. Stamens 1-10, inserted on the throat of the calyx; the filaments short. Carpels 1-2, included within, but not connate with, the calyx-tube, sessile. Achenia dry, coriaceous. Seed pendulous, with a membranaceous testa. Radicle short, superior. — Herbs, sometimes somewhat woody at the base, decumbent or somewhat spreading, glabrous or sericeous. Flowers spiked at the apex of an erect bracted scape. Leaves alternate, imparipinnate, leaflets incised or serrate, sometimes multifid. Stipules adnate to and sheathing the base of the petiole. Fruits often in a spiny head.

Genus of about 30 species, found in cold and temperate regions.

A. EXIGUA Gray. (*Enum. No. 126.*) Scape 4'-6' high, from a very dense rosulate cluster of leaves about an inch long. Leaflets 7-8 pairs, crowded, very small, ovate or oblong, commonly two-lobed or toothed, the upper surface bullate, glabrous and shining, the lower concave, whitened with a minute close-pressed pubescence. Inflorescence a small, cylindrical spike, about $\frac{1}{4}$ ' long. Flowers minute, crowded, subtended by subulate bracts. Calyx-lobes 4 or 5, oblong, glabrous; the ovoid tube covered with slender bristles, retrorsely barbed at the apex.

On the summits and higher parts of the mountains of West Maui and Kauai.

4. OSTEOMELES Lindl. [Ulei.]

Calyx-tube campanulate or turbinate, adnate to the carpels, 5-lobed; lobes lanceolate or subulate, acute, persistent. Petals 5, oblong spreading. Stamens 10-many, inserted on the throat of the calyx. Carpels 5, more or less concrete among themselves. Styles as many; stigmas thick and truncate. Ovules solitary in each cell, erect. Fruit a pome, or berry-like, the hard pyrenæ often cohering among themselves, and often not adhering to the calyx at the apex. Seed erect, compressed, with a membranaceous testa. — Trees or branching shrubs. Leaves alternate, petioled, coriaceous, evergreen, simple or

in one species (the Hawaiian) imparipinnate with entire leaflets. Stipules small. Flowers corymbed, few or numerous, bracted.

Genus of 8 species, all natives of the Andes, except the Hawaiian one, which differs from the others in having pinnate leaves.

O. ANTHYLLIDIFOLIA Lindl. (*Enum. No. 127.*) A low, very much branched and widely spreading shrub; the young branches, &c., finely silky with soft hairs. Leaves $1\frac{1}{2}$ '-3' long. Leaflets 11-21, oblong, obtuse and usually mucronulate, rarely retuse, cuneate at the base and sessile, 3''-9'' long, smooth and shining above, silky-hairy beneath, or sometimes glabrate. Peduncles 1-few-flowered, and, with the calyx, silky or downy. Calyx-lobes ovate-lanceolate, a little more than 1'' long, one-third the length of the oblong obtuse white petals. Fruit at first hirsute, at maturity smooth, white and edible, $\frac{1}{4}$ ' or more in diameter.

Very common in many places. Also (a smaller leaved form) from the Loo Choo and Bonin Islands.

ORDER XXVII. SAXIFRAGACEÆ.

Herbs, shrubs, or trees, with alternate or opposite leaves. Calyx of 4-5 more or less united sepals, either free from or more or less adherent to the ovary, persistent. Petals as many as the sepals, rarely wanting. Stamens as many or usually twice as many or more, perigynous. Ovaries or cells mostly 2 (but in our plant 5) usually united below and distinct above, sometimes completely united and even the styles also. Seeds numerous, with a straight embryo, in fleshy albumen. — A very diversified order.

1. BROUSSAISIA Gaud. [Kanawao.]

Flowers polygamo-dioecious. Male: Calyx short, free, 5-parted, the lobes triangular or ovate-lanceolate. Petals 5, larger than the sepals, oblong, with a valvate æstivation, deciduous. Stamens 10, inserted with the petals at the base of the calyx; filaments thick, subulate; anthers ovate, 2-celled, longitudinally dehiscent. Ovary imperfect, the ovules abortive. Female: calyx-tube ovoid more or less adnate to the ovary, with a more or less free, 5-parted persistent limb. Petals small, scale-like persistent. Stamens none? ovary 5-celled; the placenta thick, projecting from the angles of the cells, 2-parted, many-ovuled. Style very short; stigma thick, radiately 5-lobed. Fruit a many-seeded berry. Seeds oblong, anatropous, with a striate testa. — Much branched shrubs with opposite or whorled leaves, without stipules. Cymes terminal and many-flowered.

Genus peculiar to the Hawaiian Islands.

1. *B. ARGUTA* Gaud. (*Enum. No. 128.*) Large shrub or small tree,

with stout branches marked with very large leaf-scars; when young hirsute, as is the inflorescence, with strigose hairs, at length glabrate. Leaves opposite or in verticils of 3, ovate-oblong or narrowly oblong, 4'-8' long, 1½' - 3¼' wide, acute, tapering at the base into the petiole, coriaceous, feather-veined from the stout midrib, closely serrate with fine and incurved callous teeth, glabrous above, the midrib and veins beneath strigosely hairy, especially when young. Petiole 6"-20" long, very much dilated at its insertion. Primary divisions of the cyme subtended by foliaceous bracts, 1' or less in length. Pedicels 1"-3" long. Bractlets minute and caducous. Fruit 3" in diameter, bright red when ripe. Seed ¼" long. Some botanists distinguish two species, one with opposite and the other with verticillate leaves (*B. pellucida* Gaud.), but the other characters are hardly sufficient.

Not uncommon in mountain woods.

ORDER XXVIII. DROSERACEÆ.

Small herbs, growing in swamps, usually covered with gland-bearing hairs; with the leaves rolled up from the apex to the base in veneration (circinnate): stipules none. Calyx of 5 persistent sepals. Corolla of 5 petals, withering and persistent, convolute in æstivation. Stamens 4-20. Styles 3 to 5, distinct or nearly so, and each two-parted (so as to look like 10 styles), and these divisions sometimes two-lobed or many-cleft at the apex. Fruit a 1-celled capsule, opening loculicidally by 3 to 5 valves, with 3 to 5 parietal placentæ. Seeds usually numerous. Embryo small, at the base of cartilaginous or fleshy albumen.

1. DROSERÆ L.

Stamens 5. Styles 3, or sometimes 5, deeply two-parted, so that they are taken for 6 or 10, slender; stigmatose above on the inner face. Pod globular or oblong. — Low perennials; the leaves (with reddish gland-bearing bristles) all in a tuft at the base; the naked scape bearing the flowers in a 1-sided raceme-like inflorescence, which nods at the undeveloped apex, so that the fresh-blown flower (which opens only in sunshine) is always highest.

A large genus, distributed throughout most of the world. The Hawaiian species the only one known from the Pacific Islands; though there are many species in extratropical Australia.

1. *D. LONGIFOLIA* Linn. (*Enum. No.* 129.) Leaves spatulate-oblong, tapering into the long, rather erect naked petioles; seeds oblong, with a rough close coat. Flowers white. — Plant raised on its prolonged caudex when growing in water.

Leeward verge of the mountains of Kauai. To be looked for on the mountain of West Maui: rare. Common in North America and Northern Europe in boggy places.

ORDER XXIX. HALORAGÆ.

Mostly aquatic herbs, with usually unisexual, minute and imperfect flowers. Calyx-tube adnate to the ovary, the limb entire, or with as many teeth or lobes as petals, which are 2 to 4, epigynous, or sometimes none. Stamens one to several. Ovary 1-4-celled, with one pendulous ovule in each cell. Stigmas as many as cells (rarely twice as many). Fruit dry and indehiscent. Seeds with fleshy albumen.

1. GUNNERA Linn. [Apeape.]

Flowers hermaphrodite or monœcious. Calyx-tube ovoid; lobes 2-3, or often imperfect or none. Petals none, or two hooded ones. Stamens 1-2. Ovary 1 celled; styles 2, subulate or filiform, papillose throughout. Drupe coriaceous, compressed 3-angled or nearly globose, with a crustaceous putamen. Seed filling the cell, and with a thin testa; the fleshy albumen abundant. Embryo very small, pyriform or obconical, in the apex of the albumen. — Perennial, sometimes gigantic herbs, with a creeping rhizoma. Leaves all radical, petiolate, ovate or cordate-rotund, simple or lobed, coriaceous, often rough. Flowers spiked, or densely clustered along the branches of large panicles, small, 2-bracted, the male ones on the upper panicles. Fruit small.

Genus of 11 species, in tropical and southern countries.

1. G. PETALOIDEA Gaud. (*Enum. No. 130.*) An immense herb, often 10° high, with a sort of stem formed or the leaf petioles. Leaves round-reniform, $1\frac{1}{2}$ ° to 4° or more in diameter, obscurely lobed, margin more or less toothed, pedately ribbed, very veiny and reticulate, bullate and rugose, nearly glabrous above, hirsute beneath, especially on the veins and ribs. Petiole roughened with small and few muricate points, which extend sometimes to the ribs. Inflorescence 2°-3° long; the spikes crowded, but spreading, subsessile, 3'-6' long. Bracts narrowly linear, 6"-9" long, and hardly 1" wide. Flowers sessile, crowded in little clusters on the rachises of the spikes, not bracteolate. Calyx-tube adnate, the lobes, anterior and posterior, persistent. Petals 2, cucullate, enclosing the stamens at first, thickish, twice as long as the calyx lobes. Stamens 2, opposite the petals. Stigmas 2, opposite the stamens, nearly twice their length. Ovary 1-celled. Drupes ovoid-globose, yellow or reddish, $1\frac{1}{2}$ "-2" long.

In wet places, high in the mountains of Kauai, Oahu, and West Maui, often clinging on cliffs.

ORDER XXX. MYRTACEÆ.

Trees or shrubs, with opposite and simple entire leaves, which are punctate with pellucid dots, and often furnished with a vein running

parallel with and close to the margin; the calyx-tube adherent to the ovary; many stamens; and seeds without albumen.—Many species are aromatic; cloves are the dried flower-buds of *Caryophyllus aromaticus*; pimento (allspice) the dried fruit of *Eugenia Pimenta*, &c. Some species of *Barringtonia*, which all have very large leaves, flowers, and fruits, are cultivated.

Fruit a dry, many-seeded dehiscent capsule, METROSIDEROS.

Fruit baccate, edible, with numerous seeds in pulp, PSIDIUM.

Fruit drupaceous, with few or only one seed ripening, EUGENIA.

1. METROSIDEROS Banks. [Ohia lehua.]

Calyx-tube campanulate or urn-shaped, more or less adnate to the ovary; lobes 5, slightly imbricated. Petals 5, spreading. Stamens indefinite, much longer than the petals, in 1-many series, free. Ovary 3-celled; style filiform; stigma small or truncate. Ovules very many in each cell, densely covering the placenta, which are at the inner angle of the cell, horizontal or slightly ascending. Capsule loculicidally or rarely irregularly dehiscent on the top. Embryo straight.—Trees or shrubs, which are rarely climbing. Leaves opposite or rarely alternate. Flowers usually very showy, in dense di-trichotomous cymes which are either terminal or axillary.

A small genus, mostly of Pacific Islands and New Zealand.

1. *M. POLYMORPHA* Gaud. (*Enum. No. 131.*) A small or large tree 2°–100° high, with variously shaped leaves, either glabrous, pubescent, or tomentose, and with red or yellow flowers, and, as the name indicates, taking a great variety of forms, of which the following are some of the more marked. The leaves not rugose, nor the cymes with large persistent bracts.

Var. 1. Leaves elliptical or orbicular, more or less cordate at the base and very short petioled, or sessile, obtuse at the apex, often broader than long, $\frac{1}{4}$ – $\frac{1}{3}$ in diameter, finely canescently-tomentose beneath, glabrous and shining above, crowded and frequently imbricated on the branches. Cymes on short or somewhat lengthened peduncles, which with the calyx-tubes are densely tomentose, few-several-flowered. Flowers rather small, bright red.

Var. 2. Leaves elliptical or oblong, very thick-coriaceous, cordate at the base, obtuse at the apex, on petioles 2''–3'' long, more than 1' long, densely tomentose beneath, as are the peduncles and calyxes, or sometimes the leaves nearly glabrous. Flowers larger.

Var. 3. Like var. 2, but entirely glabrous throughout.

Var. 4. Leaves coriaceous, oblong, 2' long and tapering to the base into a petiole $\frac{1}{4}$ – $\frac{1}{2}$ long, obtusish at the apex, and entirely glabrous. Cymes loosely flowered. The large calyxes tomentose.

Var. 5. Leaves broadly oval or oblong, somewhat rounded at the base, or tapering, obtuse or obtusish or acuminate at the apex, petioled, 1'–2½' long, entirely glabrous. Cymes loosely many-flowered, glabrous or sometimes minutely puberulent.

Var. 6. Leaves lanceolate or narrowly lanceolate, acute at both ends, on a more or less elongated petiole, glabrous throughout. Cymes very loosely few-many-flowered, glabrous or minutely puberulent.

Var. 7. LUTEA. Leaves almost as variable as in the foregoing varieties as to form and pubescence, as are the cymes which are compactly or loosely flowered, glabrate or tomentose. Flowers yellow.

Everywhere in forests, and the principal forest tree of the Group. Some of the varieties have distinctive native names.

2. *M. RUGOSA* Gray. (*Enum. No. 132.*) Leaves coriaceous, bullate-rugose above and glabrous, beneath with very strong and prominent veins and tomentose with a close persistent, tawny or deeply ochreous wool; on short petioles; they are about 1' or less in diameter, obtuse, and the margins strongly revolute. Peduncles few-flowered, quite short; the calyxes tomentose. Flowers rather small. Petals and stamens deep red, the former pubescent externally.

Oahu, and doubtless elsewhere. Perhaps to be included in the preceding species.

3. *M. MACROPUS* Hook. & Arn. (*Enum. No. 133.*) Tree of medium size, 25°–35° high, and glabrous throughout. Leaves broadly ovate or ovate-oblong, obtuse or usually acute at the apex, coriaceous, rather dull, copiously feather-veined, 1½'–2½' long, 1'–2' wide, on a long, usually margined petiole, and standing nearly at right angles to the stem. Cymes terminal, or by the growth of the stem becoming lateral, subsessile, many-flowered, crowded, evolved from a large scaly bud, the scales remaining persistent for some time, as ovate or oblong pointed bracts, of a chartaceous or coriaceous texture, and ½' long. Pedicels (1½''–2'' long, or in fruit even 4'' long) subtended by smaller ovate-lanceolate bractlets, which are early deciduous. Flowers large. Stamens reddish or pale and even yellowish. Ovary free nearly to the middle, the capsule nearly included in the calyx-tube, 3-valved, many-seeded. Seed fusiform-subulate, not much pointed.

Mountains behind Honolulu, Oahu.

2. *PSIDIUM* Linn.

Calyx-tube ovate and adnate at the base; the upper free portion quite entire and closed over the flower in the bud, and coming off entire or splitting irregularly. Petals 4 or 5, free. Stamens numerous. Ovary 2 or more celled, with many ovules in each, inserted on bifid axile placentæ. Fruit a berry. Seeds several, kidney-shaped or

horseshoe-shaped. Embryo curved, with a long radicle and short cotyledons. — Trees or shrubs. Leaves opposite. Flowers solitary or few together, on axillary peduncles.

The genus is exclusively American, the following species being naturalized in the Old World.

1. *P. GUAJAVA* Linn. (*Enum. No. 136.*) A tree, pubescent on the young branches. Leaves on very short petioles, ovate or oblong, usually acute, 3'–4' long, 1½'–2' wide, glabrous or nearly so above, softly pubescent beneath, with the principal veins very prominent. Peduncles axillary, ½'–1' long, 1–3-flowered. Buds ovoid in the adnate part; the free part also ovoid, but much larger and more or less acuminate or pointed, puberulent or tomentose. Petals broad, fully ½' in diameter. Stamens numerous, but not especially long. Fruit globular or pear-shaped, known as *Guajava* or *Guava*.

Very abundantly introduced and naturalized in many places.

3. *EUGENIA* Linn.

The globose, or more or less elongated calyx-tube scarcely or somewhat produced beyond the ovary; the limb 4 or rarely 5-toothed. Petals 4, rarely 5, or more, or none, distinct and spreading, or more or less adnate. Stamens indefinitely numerous, in many series, free, or their bases united in (usually 4) phalanges. Ovary 2- or rarely 3-celled; style filiform, with a small stigma. Ovules indefinite, or very rarely 2–4. Berry somewhat drupaceous or pulpy, rarely nearly dry and fibrous, crowned by the persistent limb of the calyx. Seeds few, usually 1–4, with a firm but thin testa. Embryo very thick; radicle short. — Trees or shrubs, usually glabrous. Flowers variously arranged, fascicled in the axils or on short racemes, or in dense terminal cymes, or terminal or lateral panicles. Bracts and bractlets usually small and very caducous, rarely large and persistent.

JAMBOSA: Flowers large; calyx-lobes large. Petals remaining when the flower opens.

SYZYGIIUM: Flowers small; calyx-lobes very short. Petals more or less united in a calyptra, and falling off as soon as the flower opens.

A very large genus, found principally in tropical South America and tropical Asia.

1. *E. (JAMBOSA) MALACCENSIS* Linn. (*Enum. No. 135.*) A large tree, 40° high, glabrous throughout. Leaves ovate-lanceolate or oblong, coriaceous, obtuse or shortly pointed, abruptly tapering into a petiole 4''–5'' long. Peduncles axillary, often on the naked stems far below the leaves (perhaps adventitious) about 1' long, bearing a few large pink or crimson or sometimes pure white flowers on short (3''–4'' long) pedicels. Calyx-lobes broad and rounded, 1'' long. Petals roundish, entire, or slightly eroso-crenate, 2''–3'' long. Sta-

mens indefinite, about 1' long, and the principal beauty of the flower. Fruit about 2' in diameter, longer than broad, dark purple when ripe, juicy and edible.

Very common in valleys and on the lower slopes of the mountains in most places. The *Rose-apple* is also found in the Society and Viti Islands, and in the East Indies. *Native name*, "Ohia ai."

E. (*SYZYGium*) *SANDWICENSIS* Gray. (*Enum. No.* 136.) A shrub at times, often a very large forest tree. Branches, as the whole plant, glabrous; the leafy branchlets 4-sided, with sharply margined angles. Leaves coriaceous, obovate or oblong, cuneate at the base, 3'–5' long, or on small trees smaller, obtuse or pointed at apex. Petioles 3''–4'' long. Peduncles axillary, solitary, rather slender, angled, shorter than the leaf, bearing a small, once or twice trichotomous cyme of several flowers, on short pedicels. Flower-buds 1½'' long, subclavate or turbinate. Limb of the calyx very short, 4-lobed. Petals 4, 1'' long, caducous. Stamens few, 20 or more, little longer than the lobes of the calyx, inserted on the edge of the disk. Style shorter than the stamens. Ovary 2-celled, with 10 or more ovules in each cell. Berry globular, ½' or less in diameter, dark red when ripe, pleasantly acid and edible; ripening 2 or 3 seeds.

Common in mountain woods. *Native name*, "Ohia ha."

ORDER XXXI. LYTHRARÆ.

Herbs or shrubs, with opposite or whorled (rarely alternate) entire leaves. Calyx tubular, enclosing the 2–4-celled ovary, but free from it, and with the petals and stamens perigynously inserted in its tube. Styles perfectly united into one: the fruit a thin capsule: and the seeds without albumen.

1. *LYTHRUM* Linn. [*Pukamole*.]

Calyx-tube cylindrical, striate; teeth short, 4–6, usually with as many minute intermediate teeth or processes. Petals 4–6. Stamens as many or twice as many as petals, inserted about the middle or near the base of the calyx, nearly equal. Style filiform: stigma capitate. Capsule oblong, 2-celled, many-seeded, enclosed in the calyx. — Herbs, or rarely undershrubs, with opposite or scattered entire leaves, and purplish or white flowers.

Genus found in most hot and tropical countries; the species often sea-side plants.

1. *L. MARITIMUM* HBK. (*Enum. No.* 137.) A low spreading undershrub, the stem often angled or wing-margined; glabrous throughout. Leaves opposite, linear oblong, or oblanceolate, usually obtuse, or tapering towards the base, sessile or very nearly so, paler beneath,

4''-10'' long, 1''-3'' wide. Flowers solitary in the axils, on short peduncles 1'' or more long, which are 2-bracted below the middle. Calyx-tube about 3'' long, the awn-shaped teeth less than a line in length. Petals 1''-2'' long, purple.

On cliffs, and in rocky or sterile places, not uncommon. Also from the coast of Peru.

2. CUPHEA Jacq.

Calyx tubular with the superior base enlarged or saccate, striate and at the summit 6-toothed. Petals 6 or 7, unequal. Stamens about twice as many, or as many as the petals, unequal, inserted in the throat of the calyx. Style filiform: stigma simple or notched. Capsule 1-2-celled, membranaceous, enclosed in the calyx.—Herbs or shrubs. Leaves opposite or rarely whorled, entire or nearly so. The axillary or interpetiolar peduncles 1- or rarely many-flowered; flowers purple or white.

A considerable genus, found in most hot countries.

C. *BALSAMONA* Cham. & Schlecht. (Enum. No. 138.) A hard and erect annual, 1°-2° high; the stem, branches, petioles, &c., hispid, with short, stiff, erect, glandular hairs. Leaves opposite, ovate, acute at both ends, glabrous excepting a few stiff hairs on each surface, minutely serrate, $\frac{3}{4}$ '-1 $\frac{1}{4}$ ' long, $\frac{1}{4}$ ' more or less wide. Flowers solitary or a few in each axil of the uppermost leaves, short peduncled. Calyx 3'' long, bulging or slightly saccate at its upper base, very short toothed, slightly hispid. Petals 2''-3'' long, purple. Stamens 11. Style short and included. Ovary few-ovuled.

Kauai. Probably introduced. Native of Brazil.

ORDER XXXII. ONAGRACEÆ.

Herbs, or rarely shrubby plants, with alternate or opposite leaves, not dotted nor furnished with stipules. Flowers usually tetramerous. Calyx adherent to the ovary, and usually produced beyond it into a tube. Petals usually four, and the stamens as many, or twice as many, inserted into the throat of the calyx. Ovary commonly 4-celled: styles united. Fruit mostly capsular.—*Fuchsia*, remarkable for its colored calyx and berried fruit, is much cultivated for ornament.

1. JUSSIEA Linn. [Kamole.]

Calyx-tube not produced above the ovary; the limb divided to the base into 4 or rarely 5 segments. Petals as many. Stamens twice as many. Stigma capitate. Capsules 4 or 5-celled, crowned by the calyx-segments and opening longitudinally between the ribs. Seeds numer-

ous, small. — Herbs. Leaves alternate. Flowers axillary, solitary, yellow or rarely white.

A genus of several American species, with a few spread over Asia and Africa.

1. *J. VILLOSA* Lam. (Enum. No. 140.) An erect perennial, pubescent or hairy, attaining 2° – 3° , and often hard, almost woody, at the base. Leaves from oblong- to linear-lanceolate, $1\frac{1}{2}'$ – $3'$ long, narrowed into a short petiole. Flowers almost sessile in the axils. Calyx-tube about $\frac{1}{2}'$ long, when in flower; the segments ovate-lanceolate, about $3''$ long. Petals broad, rather longer than the calyx. Capsule nearly cylindrical, $1'$ – $1\frac{1}{2}'$ long, 8-ribbed, pubescent, contracted at the base into a short pedicel. Seeds minute. — *J. octoflora*, DC.

Common in taro ponds, and in wet places. Widely distributed over the warmer regions of America as well as Asia.

ORDER XXXIII. CACTACEÆ.

Succulent shrubby plants, peculiar in habit, with spinous buds, usually leafless: the stems either globular and many-angled, columnar with several angles, or flattened and jointed. Flowers usually large and showy. Calyx of several or numerous sepals, imbricated, coherent with and crowning the 1-celled ovary, or covering its whole surface; the inner usually confounded with the indefinite petals. Stamens indefinite, with long filaments, cohering with the base of the petals. Styles united: stigmas and parietal placentæ several. Fruit a berry. Seeds numerous, with a curved or fleshy and rounded embryo, and little or no albumen. — All American.

Numerous species are cultivated, both for their peculiarities of form, and for the showy flowers. One (a species of *Opuntia*) has been much used for fencing, and is now established over large parts of the dryer and more barren regions of the Islands. — For a good popular description of these plants, see "*Field, Forest, and Garden Botany*," by Prof. A. Gray.

ORDER XXXIV. PASSIFLORACEÆ.

Herbs, shrubs, or (rarely) trees, with watery juice, and usually climbing by tendrils; with alternate, entire, or palmately lobed leaves, mostly with stipules; and hermaphrodite or unisexual, often showy, regular flowers (in *Papayaceæ* the male and female dissimilar). Calyx mostly of 5 sepals, united below, free from the one-celled ovary; the throat bearing 5 petals and a filamentous crown. Stamens as many as the sepals, monadelphous and adhering to the stalk of the ovary, which has usually 3 club-shape styles or stigmas, and as many parietal placentæ. Fruit fleshy or berry-like. Seeds numerous, with a brittle sculptured testa, enclosed in pulp. Embryo surrounded by a thin albumen. — Here belong the showy Passion-flowers, much cultivated for ornament, and several species of which yield edible fruits known as Granadilla, &c.

Our only genus belongs to a section of the Order, having but slight affinities with the true Passion-flowers.

[To be continued.]

XII. *Catalogue of the Birds of North America contained in the Museum of the Essex Institute;—with which is incorporated A List of the Birds of New England. With brief Critical and Field Notes.*

BY DR. ELLIOTT COUES, U. S. A.

[Communicated January 7, 1867.]

It is with pleasure that I accede to a request made by Mr. F. W. Putnam, Superintendent of the Museum of the Essex Institute, to identify and prepare a Catalogue of the North American Birds contained in the Collection.

The Ornithological department of the Museum, although not very extensive, so well illustrates, as every local collection should, the species of the immediate vicinity, that, by the addition of a comparatively few desiderata, it may easily be rendered a complete exponent of the Birds of Essex County. Numerous species of other portions of North America, and a number of exotic species are also represented. The entire collection is in a state of preservation rarely equalled in a public museum, and is an encomium upon the scientific taste and enterprise of the community which requires no comment.

In preparing a Catalogue of the Birds of the Essex Institute Museum, I had at first intended merely to present, in addition, a synopsis of the birds of the County of which the collection does not contain examples, for the purpose of showing exactly what were its desiderata among the species of the immediate vicinity. But the Avifauna of the County, with a few exceptions, does not differ in a notable degree from that of the State at large; of which so many excellent lists have already appeared, that an additional one would be entirely superfluous.*

There are also at our disposal several other local lists of various localities throughout New England. It has

*That of Mr. J. A. Allen's, in particular, would be difficult to improve upon as regards completeness, accuracy, and interest; and is, I think, one of the most perfect samples of a local list I have ever had the pleasure of perusing.

occurred to me that a paper which should combine these different catalogues, or in other words present a complete list of the Birds found in New England was still a desideratum, and might prove an acceptable contribution to Ornithology. I have accordingly endeavored to render the following pages an exposition of the present state of our knowledge as regards the distribution of species in this section of the country.

A simple enumeration of the names of species known to occur, without regard to special points concerning each of them, is, as has been frequently and justly remarked, of comparatively little value in determining the real characteristics of the Fauna of any particular locality. For among the species represented, some are purely accidental, and others only occasional or very rare visitors, whose occurrence is entirely exceptional, and contrary to the law ordinarily regulating their habits and distribution. A very large proportion are species which only pass through the region during their migrations; and of those which regularly summer or winter, or are permanent residents, some are very abundant, and, so to speak, characteristic, while others are of comparatively infrequent occurrence. The value of a local list seems to me to depend in a great measure upon the just discrimination of these several classes; and cannot be said to approach completion unless these points are fully elucidated.

I have experienced some little difficulty in attempting to fulfil this indication, in consequence of the extent of country whose birds are to be presented. Within the area of New England, as is well known to those familiar with the distribution of our species, are represented portions of two Faunæ* which differ in many respects from each other. There seems to be a natural dividing line between the birds of Massachusetts and Southern New England generally, and those of the more northern portions of the Eastern States. Numerous species which enter New England in spring, to breed

*The "Canadian" and "Alleghanian."—Professor Verrill's paper on the birds of Norway, Me., contains some interesting remarks upon this subject.

there, do not proceed, as a general rule, farther north than Massachusetts; and many others, properly to be regarded as stragglers from the South in summer and early autumn, are rarely if ever found beyond the latitude of this State. In like manner, many of the regular winter visitants of Maine are of rare or only occasional occurrence, or are not found at all much farther south. Again, many species hardly known in Massachusetts and southward except as migratory species passing through in spring and autumn, are in Maine regular summer visitants, breeding abundantly. Other minor differences, resulting from latitude and physical geography, will readily be brought to mind by attentive consideration of the subject, and therefore need not be here detailed. It will be evident that a due regard for these important points has necessitated, in the case of almost every species in the list, remarks elucidative of the special part it plays in the composition of the Avifauna.

In the following list the New England species are given in *italics*, and those contained in the Museum of the Institute are followed by the numbers and localities of the specimens in the collection. All other North American species represented in the Museum are printed in "Roman." The list is thus made an exponent of the present condition of the Museum so far as North American birds are concerned, without interference with its character as a synopsis of those of New England. The nomenclature adopted is mainly that of Professor Baird's "Birds of North America," with such modifications as my own investigations have led me to adopt.

I take pleasure in acknowledging the free use I have made of previously published local lists, for obtaining data relative to the comparative abundance or scarcity of species, their times of arrival and departure, and for information upon particular points which a general knowledge of the distribution of species does not afford. Information relative to the accidental occurrence of species in particular localities must necessarily be chiefly drawn from these sources; and I have in every such instance been careful to insert references. For all statements for

which no authority is cited, and for the identifications of specimens in the Museum, I am solely responsible.

The reader is referred to the following authorities for corroborative or additional information upon the subject:

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- VERR. — Prof. A. E. Verrill; Additions to the Catalogue of the Birds found in the vicinity of Calais, Maine, and about the Bay of Fundy. Proceedings of the Boston Society of Natural History, vol. ix, p. 233. 1863.
- SAM. — E. A. Samuels; * Descriptive Catalogue of the Birds of Massachusetts. Boston, 1864. Appendix to Report of Secretary of Agriculture, Mass., for 1863. (Repaged.)

* This author has recently published a more extensive work on the Birds of New England; but his "Catalogue" is much more complete, as far as it goes, and otherwise more satisfactory, than his more pretentious volume. The latter, — entitled "Ornithology and Oölogy of New England; containing full descriptions of the Birds of New England, and adjoining States and provinces, arranged by a long-approved classification and nomenclature; together with a complete history of their habits, times of arrival and departure, their distribution, food, song, time of breeding, and a careful and accurate account of their nests and eggs; with illustrations of many species of the Birds, and accurate Figures of their Eggs" — is not by any means what we should expect to find it, from its title. We are constrained to regard it as a work that only very imperfectly and inadequately represents, and therefore cannot become an authority upon, the subject. The descriptions are very good, and are copied from Prof. Baird's work. Many of the biographies are excellent, and are copied from Wilson, Audubon, Nuttall, and others. Nearly all the wood-cuts are reproduced from Audubon, and most of them have already been used before, in a government Report. They are as much like Audubon's originals as could be expected under the circumstances. The colored plates of the eggs are the best things in the book; it is much to be regretted that only thirty eggs are illustrated; also that the writer has been able to describe the nests, eggs, and breeding habits of

- ALL.—J. A. Allen; Catalogue of the Birds of Springfield, Mass., with a list of Birds found in Massachusetts not observed at Springfield. Proceedings of the Essex Institute, vol. iv, p. 48. 1864.
- HAM.—Prof. C. E. Hamlin; Catalogue of the Birds found in the vicinity of Waterville, Kennebec Co., Me. Reprinted from the Report of the Secretary of the Maine Board of Agriculture for 1865.
- MCL.—T. McIlwraith; List of Birds observed near Hamilton, Canada West. Proceedings of the Essex Institute, v, p. 79. 1866.
- LAWR.—G. N. Lawrence; Catalogue of Birds observed on New York, Long and Staten Islands, and adjacent parts of New Jersey. Annals of the Lyceum of Natural History of New York, vol. viii. 1866.
- B. S. N. H.—Proceedings of the Boston Society of Natural History. 8vo. Boston, 1841, et seq. *passim*. Various papers and notes on New England Birds, by Drs. Abbot, Brewer, Bryant, Cabot, Kneeland, and others. Especially vols. ii, pp. 36, 248; iii, pp. 186, 313, 326, 333, 335; iv, p. 346; v, pp. 154, 195; vi, pp. 386, 419, etc.

In addition to the preceding, numerous references to Birds of New England are to be found in Nuttall's Manual of Ornithology; in the Biographies of Audubon; in Brewer's North American Oölogy; in the Birds of North America by Baird, Cassin, and Lawrence; and in Baird's Review of American Birds.

VULTURIDÆ.

Cathartes aura Illig.—Turkey Vulture. Turkey Buzzard. Rare or occasional summer visitant, chiefly in more southern portions. (Calais, Me., *Verr.*, p. 122; one instance.—Mass., two instances, *Sam.*, p. 3; *All.*, p. 81.—Regular summer visitant near Chatham, and along the shores of Lake St. Clair. *McIl.*, p. 80.—Omitted from *Sam. O. O.*)

so very small a per centage of the New England birds. The original portions of the text are not better, nor much worse than the average of ornithological writings as regards style, accuracy, and completeness. But the great blemish of the work is the omission of thirty or forty species properly to be enumerated as Birds of New England. We can find no excuse for such carelessness as this. We cannot attribute it to Mr. Samuel's want of knowledge in the matter; for surely he cannot be ignorant of Mr. Putnam's, Mr. Boardman's, Prof. Verrill's, Mr. Allen's, and others' local lists, —not to mention his own "Descriptive List," in which several species are given that do not appear in his latter work,—either of which would put him in possession of much additional matter for his work. It is not to the point that many, or most, of the species he omits are rare, occasional, or accidental visitors in New England. Such a work as his professes to be should at least make mention of every bird that has actually been found in New England "and adjoining States and provinces."

In the present list—perhaps more needed since, than before the appearance of Mr. Samuel's work—we notice Mr. Samuel's omissions in detail; and the reader is left to judge for himself, in each instance, what sort of authority we have for including those species that we condemn Mr. Samuel for omitting. We quote Mr. Samuel's later work as "*Sam. O. O.*" to distinguish it from his Descriptive List, referred to by the abbreviation "*Sam.*"

Cathartes atratus Less. — Black Vulture. Carrion Crow. Entirely accidental. (Swampscott, Nov. 1850, *S. Jillson*, quoted by *Putn.*, p. 223. — Gloucester, Sept. 28, 1863, *Verrill*, quoted by *All.*, p. 81. — *Brew. Oöl.*, p. 5. — Omitted from *Sam. O. O.*)

FALCONIDÆ.

*Fulco anatum** Bon. — American Peregrine Falcon. Duck Hawk. Resident and generally distributed, though nowhere very abundant. Chiefly a winter visitant in more southern localities, though known to breed in Mass. and Ct. (Near Springfield, Mass., *C. W. Bennett*, quoted by *All.*, p. 50. — Near Hartford, Ct., *W. Wood*, in *Hartf. "Times,"* June 24, 1861.) Regularly breeds in various portions of Maine.

It is very questionable whether this bird be more than a geographical race or variety of the Old World *F. peregrinus*. Numerous other forms (among them *F. nigriceps* Cass., from western North America), from various parts of the world, are known to exist, all of which are intimately related to the European bird.

No. 11, ♀, adult. Off Bermuda, Capt. George Upton, Oct. 29, 1849.

Falco sacer Forster. — Jerfalcon or Gyrfalcon. "White" or "Speckled" Hawk. — Rare winter visitant; and only accidental as far south as Mass. I cannot find an authentic instance of its breeding in New England. (Norway, Me., "not uncommon;" *Verr.*, p. 4. — Mass., *Peab.*, p. 260. — Sekonk Plains, Mass., *Jillson*, quoted by *Putn.*, p. 226, and by the other State authorities. — Omitted from *Sam. O. O.*)

The Jerfalcon which visits New England is variously given as "*Islandicus*" or "*candicans*." I do not know which is really the proper name, nor whether more than one species be found. I believe it is still an open question among ornithologists, whether these two names do not refer to the same species; or in other words whether there is really more than a single valid species of Jer-

* For some exceedingly interesting information upon the habits and especially the nidification of this Hawk, see Allen, *Pr. E. I.*, 1865, p. 153.

falcon. Mr. John Cassin, in reply to some inquiries of mine upon this subject, kindly furnishes me with the following: "I regard the species of *Hierofalco* of northern America as the *F. candicans* of authors (e. g. Bon. Consp. Av., etc.).—*F. cinereus* Gmelin; *F. Grœnlandicus* Daudin; *F. Labradora* Aud. (name on plate); *F. sacer* Forster; which latter is the name which has priority."

Falco columbarius Gm.—Pigeon Hawk. Generally distributed. Not abundant. Resident. Breeds at least as far south as Massachusetts.—(*Sam.*, p. 3.) It ranges through the Middle and into the Southern States in winter.

The "Little Corporal" *F. temerarius* Aud., Nutt., of *Peab.* (p. 261; *Lins.*, p. 251), is based upon this species in one of its protean plumages, when its upper parts are light slate-blue, as occurs chiefly in very adult birds. There is possibly a second species of *Hypotriorchis*, the European *F. æsalon*. Examine in this connection *Coues*, Pr. A. N. S., Phila., 1866, p. 42; and for the occurrence of supposed *æsalon* in Mass., see *Peab.* (p. 270), who quotes Nuttall as authority.

No. 17, ♂, adult. Essex Co. H. P. Ives, Sept. 25, 1858.

No. 36, young. Essex Co. Thomas H. Johnson, 1861.

Falco sparverius Linn.—Sparrow Hawk. Resident. Generally distributed and common; breeds throughout New England.

No. 16, ♂, adult. Essex Co. George Goldthwait.

FALCO AURANTIUS Gm.—I find an excellent example of this species in the collection.

No. 43, Brazil.

Astur atricapillus Bon.—Goshawk. "Partridge" Hawk. Generally distributed. Chiefly winter visitant, and rather uncommon in southern portions; common, and breeds, in Maine. I have also found it breeding in Labrador. Individuals in the adult blue plumage are rarely seen in Mass. (Norway, Me., "common, breeds," *Verr.*, p. 5.)

No. 22, ♂, adult. Essex Co. S. Jillson, 1853.

No. 232, ♂. Boxford, Essex Co. Thomas Fuller, Nov. 5, 1867.

No. 293, ♀, young. Topsfield, Essex Co. Mrs. Killam, Nov. 5, 1867.

No. 18, young. Lynn, Essex Co. S. Jillson, 1858.

Accipiter Cooperi Bon.—Cooper's Hawk. "Chicken

Hawk." Resident. Common in most localities. Most numerous in summer, breeding; probably the greater number retire south in winter.

No. 44. Essex Co.

Accipiter fuscus Bon. — Sharp-shinned Hawk. "Pigeon Hawk." Abundant. Resident in more southern localities, summer visitant further north. The Maine authorities do not give it as wintering in that State.

This species, in common with *F. columbarius*, has received the popular name of "Pigeon Hawk"; and local naturalists should be careful to state which of the two species they refer to in using the latter appellation. It seems that some errors of identification have arisen from inattention to this point.

No. 12, ♀. Essex Co. N. Vickary, 1860.

No. 13, ♀. Essex Co.

No. 14, ♂, adult. Essex Co.

No. 15, ♂, young. Essex Co.

Buteo borealis Vieill. — Red-tailed Buzzard. "Hen Hawk." Abundant. It probably retires from extreme northern sections in the depth of winter.

No. 4, ♂, adult. Middleton, Essex Co. Mrs. E. R. Colcord, Aug. 14, 1851.

Buteo lineatus Jard. — Red-shouldered Buzzard. "Hen Hawk." Abundant. Breeds. Resident, except in extreme northern sections, whence it retires in winter.

The large size of some northern examples, compared with others from Southern United States, has induced Prof. Verrill (p. 5) to recognize a variety *hyemalis* ex Gm.* of this species. Considered as simply expressive of an instance of the law regarding size now well known to obtain, such a procedure is entirely pertinent; but I am disinclined to allow that the differences are of the kind or degree to which are usually accorded a name, and the rank of a distinct "variety."

The "*Falco buteoides*" (Nutt., Man., 1st ed., 1832, i, p.

**F. hyemalis* Gm. is generally supposed to have been based upon the young *lineatus*, in which plumage the under parts are white, not reddish. This condition was usually regarded by our earlier ornithologists as constituting a species distinct from *lineatus*, — the "Winter Falcon," *F. hyemalis* Wils., Aud., Nutt., etc.

100), given by *Peab.*, p. 268, and *Linsley*, p. 252, is now well known to be the young of this species. Nuttall himself, in the second edition of his Manual, gives it as a synonym of the *B. "hyemalis"* (= *lineatus*, juv.).

No. 8, ♂, adult. Winter plumage. Essex Co.

No. 678 ♀, adult. Danvers, Essex Co. J. H. Sears, Apr. 13, 1868. (Shot on the nest. Eggs.)

Buteo Pennsylvanicus Bon.—Broad-winged Buzzard. Generally distributed. Common; being very abundant in some localities (e. g. Umbagog Lakes, *Verr.*, p. 6). Resident; with much the same qualification as given under head of previous species.

In addition to the preceding *Buteones* the *B. Bairdii* Hoy, originally described from Wisconsin, which has been found in Canada West by Mr. T. McIlwraith, may very possibly occur in North-western New England. *Buteo Bairdii* is one of several usually recognized species which Dr. H. Bryant (*Pr. B. S. N. H.*, 1861) is inclined to coalesce as a single species under the name of *B. Harlani* Aud., or rather *B. Swainsonii* Bon., since it is probable that Audubon's name was based upon quite a different species. (Vide infra, under head of *Archibuteo Sancti-Johannis*.) But whether *Bairdii* be permanently distinct or not, does not affect the question of its introduction into the New England Fauna.

Mr. McIlwraith gives *Buteo elegans* Cassin, as a bird of Canada West. "I have a fine specimen in adult plumage, which was shot at Baptiste Creek a few years since." So far as we are at present acquainted with the range of this species it is quite impossible for me to think that it should occur there; and I am inclined to believe, from the nature of Mr. M.'s remarks, that the specimen in question is merely a somewhat unusually dark-colored example of *lineatus*.

Archibuteo lagopus Gray.—Rough-legged Hawk. Winter visitant. Not ordinarily abundant. I can learn of no authentic instances of its breeding, although it probably does so in more northern sections. "*F. Sancti-Johannis*" of Linsley's list.

No. 1, ♂, adult. Salem, Essex Co. J. Rose, Nov. 1854.

No. 2, ♀, adult. " " " " " " " "

No. 298, adult. Hamilton, Essex Co. Mr. Burchstead, Feb. 21, 1867.

Archibuteo Sancti-Johannis Gray.—Black Hawk. Winter visitant. Appears to be nowhere abundant. Not recorded as breeding. I have seen it in summer in Labrador. Very possibly it breeds in the northern districts of Maine.

The "Black Warrior, *Falco Harlani* Aud.," which has been accredited to Massachusetts, apparently upon Nuttall's authority (*Emm.*, p. 1; *Peab.*, p. 269; *Putn.*, p. 225), should in all probability be considered as this species. *Harlani* of Audubon, according to G. R. Gray, who has examined the type specimen in the British Museum, is based upon a dark state of plumage of the western *B. montanus* Nutt.; which latter itself may not be specifically distinct from *borealis* Gm. At the same time Mr. Peabody, following Audubon, does not separate *Sancti-Johannis* from *lagopus*. Upon these points see *Bryant*, Pr. B. S. N. H., 1861; and *Coues*, Pr. A. N. S. Phila., 1866, pp. 44, 45. Still the bird may have been an unusually dark-plumaged *B. Swainsonii*, which, as I have just stated above, may possibly occur in New England.

Circus Hudsonicus Vieill.—Hen Harrier. Marsh Hawk. Blue Hawk. Summer resident, breeding abundantly. Perhaps some winter in more southern localities.

No. 9, ♂. Essex Co. Mr. Houghton.

No. 10, ♀. " " " "

Aquila Canadensis Cass. ("Falco fulvus" of some earlier American writers.)—Golden Eagle. Ring-tailed Eagle. Very rare winter visitant, occurring usually in isolated instances. Probably does not breed in New England. Specimens are taken nearly every winter at Washington, D. C.

No. 7, nearly adult. Essex Co.

Haliaëtus leucocephalus Savig.—White-headed Eagle. "Bald" Eagle. Common. Resident. Mr. Samuels' statement that it does not breed in Mass. is incorrect; vide *All.*, p. 51. (Mt. Tom, Mass.) I know it to breed as far south, at least, as Washington, D. C.

No. 5, ♂, adult. Essex Co. S. Jillson.

No. 6, young. Essex Co. Mr. Houghton.

No. 8, young. Essex Co. Mr. Burchstead.

The *H. "Washingtonii"* Aud., has been repeatedly attributed to New England. (*Emm.*, p. 1; *Peab.*, p. 262; *Lins.*, p. 251; *Putn.*, p. 226; but upon what authority is not apparent.) "I have been told by an old hunter, of an Eagle of a much larger size, killed in this region [Norway, Me.], which may have been the little known Washington Eagle of Mr. Audubon" (*Verr.*, p. 7). The species is omitted from recent lists. I refrain from comments, since, like all else that has been written and said of this bird, they would be merely threadbare conjectures.

Pandion Carolinensis Bon.—Fish Hawk. Summer resident. Not abundant. Generally distributed; but chiefly occurring over the inland Lakes and Rivers.

No. 37, adult. Essex Co., 1861.

No. 294, ♀, adult. Salem, Essex Co. H. F. Shepard, Sept. 25, 1867.

STRIGIDÆ.

Otus Wilsonianus Less.—Long-eared Owl. Abundant. Resident throughout New England. Mr. Allen (p. 51) urges the adoption of *S. Americana* Gm. (S. N; i, 1788, p. 288) for this species. Gmelin's diagnosis is not exclusively pertinent; and he says moreover that his species "habitat in America *australi*." I see no reason to supersede a definite and now well-established name for one to which, to say the least, considerable uncertainty attaches. The *Strix Americana* Audubon (Orn. Biog. iii, 1834, p. 421) is a very different species; to wit, the *pratincola* of Bonaparte.

No. 25. Essex Co. Autumn of 1859.

Brachyotus Cassini Brew. (Proc. B. S. N. H., 1866, p. 321.)—Short-eared Owl. Common resident; breeding, and, so far as we know, wintering in all sections. Upon the question of the specific distinction of the American from the European, Mr. Cassin writes me: "It is larger than the European, and darker colored;—very much like it, though!"

No. 23. Essex Co. N. Vickary, 1854.

No. 24, ♀. Essex Co. B. Grover, 1854.

No. 295, ♂. Salem, Essex Co. D. P. Waters, Oct. 25, 1867.

Syrnium cinereum Aud.—Great Gray Owl. A rare winter visitant. Found in winter throughout New England; but probably to be regarded as only a straggler to its more southern portions. None have been observed to breed in New England.

No. 31. Salem, Essex Co. F. W. Putnam, Winter of 1866-7.

No. 34. Wenham, Essex Co. James Bartlett, Feb. 1859.

Syrnium nebulosum Gray.—Barred Owl. Abundant. Resident in all portions of New England.

No. 26, ♀, adult. Essex Co. James Buffington, Nov. 27, 1854.

No. 190. Salem, Essex Co. E. S. Waters, Nov. 10, 1866.

Bubo Virginianus Bon.—Great Horned Owl. Common. Resident.

The *Strix* "*arctica* Richardson," enumerated as a bird of Massachusetts (*Peab.*, p. 276, and *Putn.*, p. 226) on the authority of Mr. Nuttall, undoubtedly refers to this species in the albescent state of plumage, which constitutes Mr. Cassin's *B. Virginianus* var. *arcticus*. The "*Strix scandiaca* Linn.," of Linsley's list (p. 253) in all probability was also based upon the same variety of *Virginianus*.

No. 33, ♂. Essex Co. T. Ropes, Oct. 1849.

No. 32, ♀. Lynn, Essex Co. J. Saul, Feb. 28, 1864.

Scops asio Bon.—Mottled Owl. Red Owl. Screech Owl. Abundant everywhere. Resident.

No. 27, ♀. (Grey plumage.) Essex Co. H. P. Ives, Nov. 1854.

No. 28. (Red plumage.) Essex Co. S. Jillson, 1858.

Nyctale Acadica Bon.—Acadian Owl. Common; especially in more northern sections of the country. Resident.

No. 29, ♂. Essex Co. S. Jillson, 1858.

No. 30, ♀. " " " " " "

Nyctale Richardsons Bon.—Richardson's Owl. ("*Ulua Tengmalmi*" Audubon, and earlier authors.) Not abundant. Chiefly a winter visitant, and rare as far south as Massachusetts. It is probably resident in the north of Maine; though not, I believe, actually observed to breed. There are repeated instances of its occurrence in winter in the southernmost New England States.

Nyctale albifrons Cassin.—Kirtland's Owl. I have

found no record of the occurrence of this species in New England, but from its known range it is undoubtedly to be found there, at least in winter, even if it does not reside permanently in the more northern portion.

Nyctea nivea Gray.—Snowy Owl. Winter resident; usually rare, but at irregular intervals not uncommon even in the southern portions of New England. It sometimes straggles even to South Carolina.

No. 45, ♂. Salem, Essex Co. E. G. Symonds, Jan. 1863.

No. 35, ♀. Beverly, Essex Co. Dr. C. B. Haddock, Nov. 27, 1854.

No. 299, adult. Wenham, Essex Co. John J. Gould, Apr. 9, 1868.

Surnia ulula Bon.—Hawk Owl. Winter resident. Of regular and rather common occurrence in Maine; but in more southern localities rare, and perhaps only accidental. It extends however throughout New England.

ATHENE HYPOGÆA Bon.—Prairie Owl. Burrowing Owl.

No. 96. Colorado Mts., west of Denver City. From the Chicago Academy of Science, 1864.

CUCULIDÆ.

Coccyzus Americanus Bon.—Yellow-billed Cuckoo. Summer resident. Not abundant; and in particular localities very rare. (Extremely rare, Springfield, Mass., *All.*, p. 52). The species extends northward into Canada. (One specimen. Hamilton, C. W., *McIl.*, p. 82.)

No. 744, adult. Essex Co.

Coccyzus erythrophthalmus Bon.—Black-billed Cuckoo. Summer resident. Common; being, according to the testimony of all observers, much more numerous than the preceding species, and, like it, extending into Canada.

At Washington, D. C., *Americanus* is very abundant, and the present species comparatively rare.

No. 745, adult. Essex Co.

No. 746, adult. Salem, Essex Co. John S. Ives, June, 1859.

PICIDÆ.

Picus villosus Linn.—Hairy woodpecker. Resident. Abundant in most localities. *Picus Phillipsii* Aud., given by *Putn.*, p. 229, is the young of this species.

Picus pubescens Linn. — Downy Woodpecker. Resident, and everywhere abundant.

No. 905, ♂. Essex Co. E. P. Emmerton, Nov. 27, 1854.

No. 906, ♀. " " S. Jillson, 1858.

Picoides arcticus Gray. — Black-backed Three-toed Woodpecker. Winter resident; not known to breed within the limits of New England. ("Probably breeds." Calais, Me., *Boardm.*, p. 122.) Extends through all its States in winter, but is very rare or even accidental in the southernmost. (Springfield, Mass., *All.*, p. 52.)

No. 901, ♂. Essex Co.

No. 902, ♀. " " S. Jillson, Nov. 21, 1855.

Picoides hirsutus Gray. — Banded Three-toed Woodpecker. A very rare winter visitant; probably only stragglers reach as far as Massachusetts. (Calais, Me., G. A. Boardman, in *Verr.*, p. 21. — Mass., *Brew.*, p. 437; *Putn.*, p. 229; *Sam.*, p. 4; *All.*, p. 82.)

Sphyrapicus varius Baird. — Yellow-bellied Woodpecker. Summer resident. Common in most localities. Extends northward into Canada. A few probably winter in the more southern portions.

No. 907, ♂, adult. Essex Co. S. Jillson, 1855.

No. 908, ♀, adult. " " " " "

No. 909, ♂, young. " " " " "

Hylotomus pileatus Baird. — Pileated Woodpecker. Black Log-cock. Generally distributed, and resident, in all well-wooded portions of New England, though apparently nowhere abundant. It is a shy, wild, and retiring species, and one that disappears more rapidly than almost any other with the clearing away of forests.

No. 887, ♂, adult. New Hampshire.

Centurus Carolinus Swains. — Red-bellied Woodpecker. A rare and perhaps only accidental summer visitor to the more southern portions. (Western Mass., "breeding," *Emm.* Springfield "accidental, May 13, 1863," *All.*, p. 53. "Said to be unknown in the eastern part of the State," *Peab.*, p. 336. "One specimen, Stratford, Conn., Oct. 16, 1842," *Lins.*, p. 263. Omitted from *Sam.* O. O.) I do not find it recorded from Maine or New Hampshire.

No. 904, ♂, adult. Locality unknown.

Melanerpes erythrocephalus Swainson.—Red-headed Woodpecker. Rare summer visitant. Comparisons of the older with more recent local authorities indicate that the species is now much less numerous than formerly. The majority of individuals do not seem to pass the Middle States in their vernal migration.

No. 903, ♂, adult. Essex Co. S. Jillson, 1855.

Colaptes auratus Swains.—Golden-winged Woodpecker. "Flicker," "Yucker," "High-holder," "Wake-up." A very common summer resident.

No. 896, ♂, adult. Essex Co. S. Jillson, 1855.

No. 897, ♀, " " " " " "

COLAPTES MEXICANUS Swains.—Red-winged Flicker.

No. 97. Fort Buchanan, Dr. Dewey; from the Chicago Academy of Science, 1864.

TROCHILIDÆ.

Trochilus colubris Linn.—Ruby-throated Hummingbird. Summer resident. Common throughout New England.

No. 300, ♂, adult. Essex Co. S. Jillson, 1853.

No. 301, ♀, " " " " " "

CYPSELIDÆ.

Chaetura pelasgia Steph.—Chimney Swift. Summer resident. Abundant.

No. 320, ♂, adult. Essex Co. S. Jillson, 1856.

No. 321, ♀, " " " " " "

No. 322. Essex Co.

CAPRIMULGIDÆ.

Antrostomus vociferus Bon.—Whip-poor-will. Common summer resident.

No. 323, adult. Essex Co. S. Jillson, 1856.

Chordeiles popetue Baird.—Night-hawk. "Bull-bat." Common summer resident.

No. 324, adult. Essex Co. S. Jillson, 1856.

HALCYONIDÆ.

Ceryle alcyon Boie.—King-fisher. Common summer

resident; but a few usually remain all winter. (*Verr.*, p. 9; *All.*, p. 54.) The species extends as far north as Labrador.

No. 325, adult. Essex Co. S. Jillson, 1859.

COLOPTERIDÆ.

MILVULUS TYRANNUS Bon.—Fork-tailed Fly-catcher. A fine example in the collection, from South America.

Tyrannus Carolinensis Baird.—King-bird. Bee-martin. Abundant summer resident.

No. 340, adult. Essex Co. S. Jillson.

No. 567, ♀, adult. " "

TYRANNUS VERTICALIS Say.—Arkansas Fly-catcher.

No. 102, adult. Farm Island, Nebraska. Dr. F. V. Hayden. From the Chicago Academy of Science, 1864.

Myiarchus crinitus Cab.—Great Crested Fly-catcher. Summer visitant; rather rare.

No. 332, ♂, adult. Essex Co. S. Jillson, 1855.

No. 334, ♀, " " " " " "

Sayornis fuscus Baird.—Pewit Fly-catcher. "Phœbe." Common summer resident. Here, as elsewhere, it is the avant-courier in spring of the small insectivorous birds. The kinds of insects upon which it chiefly delights to feed account for its early appearance, as well as for its choice of the situations it usually frequents.

No. 560, ♂, adult. Essex Co. S. Jillson, 1853.

No. 548, ♀, " " " " " "

Contopus borealis Baird.—Olive-sided Flycatcher. Cooper's Flycatcher. Summer visitant. Not abundant. "Quite common at the Umbagog Lakes." (*Verr.*, p. 10.)

No. 558, adult. Essex Co. S. Jillson, 1855.

Contopus virens Cab.—Wood Pewee. Abundant. Summer resident. Rather less numerous in the northern than in the southern sections.

No. 565, ♂, Essex Co. T. M. Pond, 1863.

No. 561, ♀, " " S. Jillson.

Empidonax Acadicus Baird.—Acadian Flycatcher. Summer resident. Not abundant. This species seems to be more restricted in its northern range than the others of the genus, apparently not proceeding much farther than

Massachusetts. It is not, I believe, recorded from Maine. But Mr. Samuels erroneously omits it from his Massachusetts list. Earlier authors speak of it as being very common, but so far as I can learn it is now quite rare. At Washington, D. C., it is by far the most abundant species of the genus.

Empidonax Traillii Baird.—Traill's Flycatcher. Summer resident; not abundant. Erroneously omitted from Mr. Putnam's list, though given by previous and subsequent authors.

Empidonax minimus Baird.—Least Flycatcher. Summer visitant. Abundant, especially in Massachusetts, where it "exceeds in abundance all the other *Empidonaces* taken together" (*All.*, p. 54). It has a very extensive northern range;—quite into arctic America.

The earlier authors appear to have always mistaken this species for *Acadicus*, and this is the reason they used to speak of the latter as being abundant. (See *Brewer*, *Am. Nat.*, I, p. 119.)

No. 549, ♀. Essex Co. S. Jillson.

No. 108, Illinois. From the Chicago Academy of Sciences, 1864.

Empidonax flaviventris Baird.—Yellow-bellied Flycatcher. Summer resident; and rather more common, I suspect, than most collectors are aware. Its range of habitat, times of migration, and general habits, are much those of *minimus*; and it is difficult to discriminate between the two at gun-shot range. *E. flaviventris* is rather a more wood-loving species than *minimus*, and perhaps breeds farther south, as I have taken it in July, at Washington, D. C., where I never saw *minimus* except during its migrations. (Omitted from *Sam. O. O.*)

TURDIDÆ.

Turdus migratorius Linn.—Robin. Chiefly summer resident, breeding abundantly everywhere; but a few doubtless remain, except in very severe winters, in the more southern portions.

No. 556, ♂. Essex Co. S. Jillson, 1853.

No. 555, ♀. " " " " " "

No. 679, ♂. (With an elongated and hooked upper mandible.) Essex Co. H. F. Shepard, Jan., 1868.

Turdus mustelinus Gm.—Wood Thrush. A moderately abundant summer resident in more southern portions; but not apparently extending much farther north than Massachusetts. Still, "common summer resident," Hamilton, C. W., (*McIl.*, p. 84.) It is not recorded in Maine lists.

Nos. 550, 551. Essex Co. S. Jillson.

Turdus Pallasii Cab. — Hermit Thrush. Abundant. Spring and autumn migrant through the more southern, and very common summer resident in the northern, portions of New England. "Has been known to breed" (in Mass., *Sam.*, p. 5). "The most common Thrush except the Robin" (Norway, Me., in summer, *Verr.*, p. 10). A few may possibly winter in New England, as individuals are "occasionally seen during the winter;" (Essex Co., Mass., *Putn.*, p. 209.) "Have not found it breeding here;" (Springfield, Mass., *All.*, p. 56.) This is the *T. "solitarius"* or *T. "minor"* of earlier general and local writers.

No. 562, ♂. Essex Co. S. Jillson.

Turdus fuscescens Steph. — Wilson's Thrush. Tawny Thrush. "Veery." Summer resident, breeding throughout New England, most abundantly in its more southern portions. "It is the most numerous here of all the woodland Thrushes, and the only one that breeds here in abundance, and the only one, excepting *T. mustelinus*," (Springfield, Mass., *All.*, p. 56.) This is the *T. "Wilsonii"* of earlier authors.

Turdus Swainsonii Cab. — Olive-backed Thrush. Chiefly a spring and autumn migrant, though many breed, more especially in the northern portions. I have not seen it recorded as breeding so far south as Massachusetts. Usually quite common. It is a species only recognized of late years, and not given in earlier local lists, either from its absence from the works of Wilson and Audubon, or from confounding it with other species.

No. 553, ♂. Essex Co. S. Jillson.

No. 554. Essex Co. S. Jillson.

No. 112. Chicago, Illinois. R. Kennicott; from the Chicago Academy of Science, 1864.

Turdus Aliciæ Baird. — Gray-cheeked Thrush. Not recorded as having been actually taken in New England, but from its now known range of habitat is undoubtedly to be found there as a spring and autumn migrant, possibly breeding in more northern sections.

A species first introduced by Prof. Baird in 1858, based upon specimens from Illinois. I have since shown that it is a very common Eastern bird, having a range of habitat as extensive as, and nearly identical with, that of *T. Swainsonii*.

Mr. J. A. Allen has attempted to show that this species is not distinct from *T. Swainsonii*. His remarks (pp. 56-7-8) illustrate very fully the well-known seasonal and other variations to which *T. Swainsonii* and *T. fuscescens* are subject; and a citation from Prof. Baird is introduced giving some of the characters of *T. Aliciæ*, with which species Mr. Allen appears to have been autoptically unacquainted at the time of writing.*

No. 111. Chicago, Illinois. R. Kennicott; from the Chicago Academy of Science, 1864.

Harporhynchus rufus Cab. — Brown Thrush. "Thrasher." Abundant summer resident, breeding throughout New England; but not going much farther north.

No. 680. ♂. Salem, Essex Co. Samuel Carlen, summer, 1867.

No. 681, ♀. " " " " " " " "

Mimus Carolinensis Gray. — Cat-bird. Common summer resident. Maine appears to be nearly its northern limit in Eastern North America.

No. 566, ♂. Essex Co. T. M. Pond, 1864.

No. 562, ♀. " " " " " " " "

Mimus polyglottus Boie. — Mocking-bird. Very rare summer resident in more southern portions, being hardly found north of Massachusetts. It is not abundant even in the Middle States.

No. 75. A cage bird, known to have lived thirteen years. C. W. Palfry, 1865.

* Examine in this connection: Baird, B. N. A., 1858, p. 217. — *Id.*, Rev. Amer. Bds., 1864, p. 21. — Coues, Pr. A. N. S., Phila., 1861, p. 217. — Coues and Prentiss, Smiths. Rep. for 1861, p. 405.

SAXICOLIDÆ.

Saxicola œnanthe Bechst. — Stone Chat. A species which occurs as a straggler from Europe, by way of Greenland, to the eastern portions of New England, especially along the coast. Mr. Cassin has recorded it from Nova Scotia, and I found it in Labrador. Long Island, *Lawrence*, Ann. N. Y. Lyc. Nat. Hist., viii, p. 282. (Omitted from *Sam. O. O.*)

Sialia sialis Baird. — Blue-bird. A summer resident, abundantly and generally distributed.

Nos. 365, 366, ♂. Essex Co. S. Jillson, 1853.

No. 367, ♀. " " " " " "

MOTACILLIDÆ.

Anthus Ludovicianus Licht. — Tit-lark. — Chiefly spring and autumn migrant. Abundant. Some probably winter in the Connecticut Valley, and a few may possibly breed high up in Maine. By far the greater number, however, go farther north to breed, and farther south to pass the winter.

No. 370. Essex Co. S. Jillson, 1855.

SYLVIIDÆ.

Regulus calendulus Licht. — Ruby-crowned Kinglet. Abundant. Spring and autumn migrant. Possibly some breed. They breed abundantly in Labrador.

No. 361, ♂, adult. Essex Co. S. Jillson.

No. 362, ♀, " " " " " "

Regulus satrapus Licht. (*Regulus cristatus* and *R. tricolor* of Linsley, p. 256.) — Golden-crested Kinglet. Common winter resident, except perhaps in the extreme north, where some doubtless breed. Is most abundant, however, in all localities, in spring and fall.

Poliophtila cærulea Sclat. — Blue-gray Gnat-catcher. A rare and perhaps accidental summer visitor. "Found in Mass., and as far north as the Canada line." (*Brew.*, quoted by *Peab.*, p. 297.) — "Nova Scotia and Connecticut." (*All.*, p. 83.) (Omitted from *Sam. O. O.*) It is very abundant as far north as the Middle States.

SYLVICOLIDÆ.

Mniotilta varia Vieill.—Black and White Creeper. Common summer resident. The majority, however, go farther north, causing it to be most abundant in spring and fall.

No. 492, ♂, adult, Essex Co. S. Jillson, 1853.
No. 360, ♀, " " " " " "

Parula Americana Bon.—Blue Yellow-backed Warbler. Common summer resident.

No. 502, ♂, adult. Essex Co. S. Jillson, Autumn, 1855.
No. 503, ♂, " " " " " 1853.
No. 504, ♀, " " " " " 1856.

Geothlypis trichas Cab.—Maryland Yellow-throated Warbler. Abundant summer resident. "*Sylvia Roscoe* Aud." (Peab., p. 313), is the young of this species.

No. 491, ♂, Essex Co.
Nos. 523, 364, ♀. Essex Co. S. Jillson, 1855.

Geothlypis Philadelphia Baird.—Mourning Warbler. Rare summer resident. Not often detected farther north than Massachusetts; in which state numerous instances of its capture are recorded. (Waterville, Me.; breeding; July; *Haml.*, p. 3.—Hamilton, C. W., *McIl.*, p. 85.)

Oporornis agilis Baird.—Connecticut Warbler. Of very rare occurrence as a summer visitor, doubtless breeding at least as far north as Massachusetts. (*Emm.*, p. 3; *Peab.*, p. 312; *Putn.*, p. 226; *Sam.*, p. 6; *All.*, p. 82.)

No. 522, ♂, Lynn, Essex Co. S. Jillson, Sept., 1856.
No. 521, ♀, " " " " " "

Oporornis formosa Baird.—Kentucky Warbler. The occurrence of this species as a rare or casual summer visitor in southern New England is to be confidently anticipated. (Near New York City, *Lawrence*, Ann. Lyc. Nat. Hist., N. Y. viii, 1866, p. 284.) I have found it breeding at Washington, D. C.

Protonotaria citrea Baird.—Prothonotary Warbler. A summer visitor; rare, and perhaps accidental. "Calais, Me., Oct. 30, 1862;" (*Boardm.*, *Verr.*, B. S. N. H., ix, p. 234, only recorded instance). It is properly a bird of the South Atlantic States, and its occurrence in New England must be regarded as exceptional. (Omitted from *Sam. O. O.*)

A certain "Orange-throated Warbler, *Sylvia auricollis*" is given as a migratory species of New England by Peabody (p. 309, and *Linsl.*, p. 257). *Auricollis* is one of the old names of the Prothonotary Warbler, and is used by Nuttall (*Man.* i, 1840, p. 431) for that species. Upon what authority it has been inserted it is not apparent. Prof. Baird has suggested to me that possibly the name was used with reference to the *Dendroica dominica* (= *superciliosa* or *pensilis* of American writers), but there is no good evidence that the latter, which is a Central American and Southern States species ever straggles as far north as New England. It is, however, given by Linsley (p. 258) upon the authority of Mr. Peabody and Dr. De Kay.

The *Sylvia montana* Wils. has also, I believe, been attributed to New England; but is a species which continues unknown to modern ornithologists.

Icteria viridis Bon. — Yellow-breasted Chat. A very rare summer visitor, not extending much if any north of Massachusetts.

Helmitherus vermivorus Bon. — Worm-eating Warbler. Very rare summer visitant; known to extend north into Maine. (*Verr.*, p. 21.)

Helmitherus Swainsoni Bon. — Swainson's Warbler. Entirely accidental summer visitor. A single instance of its capture in Massachusetts, many years ago, by Dr. S. Cabot, given by Audubon (*Orn. Biog.* v. p. 462), on the authority of Dr. Brewer, appears to have furnished the sole datum for its recognition as a New England bird by subsequent writers. (*Peab.*, p. 313; *Putn.*, p. 227; *All.*, p. 82.) I myself never saw it even so far north as Washington, D. C., and New England is wholly beyond its proper range of habitat.

Helminthophaga ruficapilla Baird. (*S. rubricapilla* of earlier writers). — Nashville Warbler. Chiefly spring and autumn migrant, but some breed throughout New England. Common.

No. 494, ♂. Essex Co. S. Jillson, 1855.

Helminthophaga peregrina Cab. — Tennessee Warbler. Chiefly spring and autumn migrant. Very rare. A few

doubtless breed in the more northern portions. "Head waters of the Penobscot in June." (*Verr.*, p. 21.) Springfield, Mass., in May and Sept. (*All.*, p. 61.) It is a species which goes very far north in the interior of America.

Nos. 519, 520. Essex Co. S. Jillson, 1855.

Helminthophaga pina Baird. — Blue-winged Yellow Warbler. Very rare summer visitor to the more southern portions. (Mass. *Imm.*, p. 3; *Cab.*, B. S. N. H., vi, p. 386; *Putn.*, p. 227; *All.*, p. 82; *Sam.*, p. 6.) Not recorded from Maine. "*S. solitaria*" of the earlier writers.

Helminthophaga chrysoptera Baird. — Golden-winged Warbler. Very rare summer visitant to the more southern portions. (Mass., *Cab.*, B. S. N. H., vi, p. 386; *Peab.*, p. 312; *Putn.*, p. 227; *All.*, p. 82; *Sam.*, p. 6.) Not recorded from Maine.

No. 493. Hudson, Mass. S. Jillson, 1862.

Helminthophaga celata Baird. — Orange-crowned Warbler. A very common species of Western North America; but Audubon's statement of its occurrence in Nova Scotia was almost its only eastern record until Mr. Allen detected it near Springfield, Mass. "Very rare; perhaps accidental" (*All.*, p. 61). Near New York City, (*Lawrence*, Ann. Lyc. Nat. Hist., N. Y., viii, p. 284.)

Seiurus aurocapillus Swains. — Golden-crowned Wag-tail. "Oven-bird." Abundant summer resident.

No. 489, ♂, adult. Essex Co. S. Jillson, 1855.

Seiurus Novæboracensis Nutt. — Water Wag-tail. Summer resident. Apparently not very abundant. The species has a most extensive breeding range, which includes the greater part of North America. In winter it mostly retires into the Antilles and Central America.

No. 490, adult. Essex Co. S. Jillson, Spring of 1855.

Seiurus Ludovicianus Bon. — Large-billed Water Thrush. Doubtless occurs in summer in the southern portions, although it has never, I believe, been actually detected in New England. (Near New York, *Lawr.*, Ann. N. Y. Lyc. viii, p. 284.) Dr. Prentiss and myself have found it common at Washington, D. C. (Smithsonian Report for 1861, p. 407.)

Dendroæca virens Baird. — Black-throated Green Warbler. Abundant summer resident. Most numerous during its vernal and autumnal migrations in the more southern districts; but I have found it breeding abundantly near Portsmouth, N. H. I believe it prefers pine woods during the breeding season.

No. 488, ♂. Essex Co. S. Jillson, 1855.
No. 497, ♀. " " " " "

Dendroæca cœrulescens Baird. — Black-throated Blue Wood Warbler. *D. Canadensis* of former writers. "*Sylvia sphagnosa* Bon., or *pusilla* Wils." (*Linsl.* p. 257), is the female or young of this species. Summer resident; common; most so during its migrations. Breeds throughout New England; most numerous in its more northern portions.

No. 514, ♂, adult. Essex Co. S. Jillson, Spring of 1855.

Dendroæca coronata Gray. — Yellow-rumped Warbler. "Myrtle-bird." Extremely abundant spring and autumn migrant. A few probably winter in more southern sections. Not known to breed except in northern portions (Calais, Me., G. A. Boardman, *Verr.*, p. 125). The species has been known to occur in Greenland.

No. 506, ♂. Essex Co. S. Jillson, 1855.
No. 507, ♀. " " " " "

Dendroæca Blackburniæ Baird. — Mrs. Blackburn's Warbler. Summer resident; not rare.

The Hemlock Warbler, "*Sylvicola parus* Aud." (*Emm.*, p. 3; *Peab.*, p. 310; *Putn.*, p. 226; *Linsl.*, p. 257, etc.), is the young of this species.

No. 495, ♂. Essex Co. S. Jillson, 1855.
No. 518, ♀. " " " " "

Dendroæca castanea Baird. — Bay-breasted Warbler. Not common. Breeds, at least in more northern sections, but is chiefly seen in spring and fall.

The Autumnal Warbler (*Sylvia autumnalis* Wils., Aud.) of local writers is the young of this species.

No. 515, ♂. Essex Co. S. Jillson, 1855.
No. 485, ♂. " " " " "

Dendroæca pina Baird. — Pine-creeping Warbler. Common summer resident; arriving very early, and re-

maining late. A species whose breeding range is much more extensive than that of most *Dendroææ*, and includes Eastern North America from Labrador at least to Georgia.

No. 82, ♀. Lynn, Essex Co. S. Jillson, Autumn of 1855.

No. 510, ♂. " " " " " 1855.

No. 559, ♂. Essex Co. S. Jillson, 1855.

Dendroæca Pennsylvanica Baird. — Chestnut-sided Warbler. Common summer resident. Although most numerous during its migrations, many breed throughout New England.

No. 486, ♂. Essex Co. S. Jillson, 1855.

No. 498, ♀. " " " " " "

Dendroæca striata Baird. — Black-poll Warbler. Abundant spring and autumn migrant; some breeding in more northern sections. (Umbagog Lakes, *Verr.*, p. 12; Calais, Me., *Boardm.*, p. 125.) A species whose northern range extends far into arctic America, and the one which passes almost latest of all through the United States on its way north in spring.

No. 496, ♂. Essex Co. S. Jillson, Spring of 1855.

No. 517, ♀. " " " " " "

No. 509, ♂. " " " " " Autumn " "

Dendroæca æstiva Baird. — Golden Warbler. Summer Yellow-bird. Abundant summer resident everywhere. A certain *Sylvia trochilus* Lath., the "yellow" or "willow" wren, which is given by some writers (*Peab.*, p. 312, *Linsl.*, p. 257), can hardly be else than the autumnal or immature plumage of this species; which has also furnished the basis for the *Sylvia Childrenii*, and perhaps, too, the *S. Rathboniæ* of Audubon's works. The "*Sylvia flava* Lath.," of Linsley, p. 258, cannot be identified. It may be either the Summer Warbler, or *D. palmarum*.

No. 487, ♂. Essex Co. S. Jillson, 1855.

No. 508, ♀. " " " " " "

Dendroæca maculosa Baird. — Black and Yellow Warbler. Chiefly spring and autumn migrant; common. But it breeds in Maine, and apparently not rarely (Calais, Me., *Verr.*, p. 234). It goes very far north in the interior of North America.

No. 499, ♂. Essex Co. S. Jillson, 1855.

Nos. 511, 512, ♀. " " " " " "

Dendroeca palmarum Baird.—Red-poll Warbler. The *Sylvia petechia* of the earlier American writers (Peab., p. 307, *Linsl.*, p. 256), but by no means the true *petechia*, which is a Jamaican species, closely related to *D. æstiva*. Common spring and autumn migrant, remaining unusually late in the fall, as I have also found to be the case in other localities. It also differs considerably in its habits from most *Dendroecæ*. A few probably breed in the more northern portions. It goes considerably farther north in summer.

No. 516, ♂. Essex Co. S. Jillson, 1855.

Dendroeca discolor Baird.—Prairie Warbler. Common summer resident as far as Massachusetts, which is about its northern limit.

No. 513, ♂. Essex Co. S. Jillson, 1855.

Dendroeca cærulea Baird.—Blue Warbler. Very rare summer resident. (*Linsl.*, p. 257; *Putn.*, p. 207.) Known to occur as far north as Nova Scotia. It is not ordinarily included in local lists. (Omitted from *Sam. O. O.*)

Perissoglossa tigrina Baird.—Cape May Warbler. Extremely rare summer resident. — ("Summer visitant; common; breeds." Calais, Me., *Boardm.*, p. 125. Springfield, Mass., May 13, 1863, *All.*, p. 63; Lynn, Mass., 1847, S. Jillson, *Putn.*, p. 207; E. Windsor Hill, Ct., Dr. W. Wood, *All.*, p. 63; Stratford, Conn., *Linsl.*, p. 256.)

For an admirable and succinct synopsis of the Massachusetts Wood-warblers, see *All.*, p. 64; and compare with a summary of those of the District of Columbia, given by Coues and Prentiss (Smithsonian Report, 1861, p. 408.)

Myiodiocetes pusillus Bon.—Black-capped Flycatching Warbler. A rather uncommon summer resident; chiefly however seen during its migrations.

No. 501, ♂, adult. Essex Co. S. Jillson, Spring of 1855.

Myiodiocetes Canadensis Aud. ("*Sylvia pardalina* Bp." of *Linsl.*, p. 256.)—Canada Flycatching Warbler, Common. Chiefly spring and autumn migrant, but many breed, and some as far south as Massachusetts. ("Breeds:

Norway, Me., *Verr.*, p. 12; do. Calais, Me., *Boardm.*, p. 125; do. Lynn, Mass., *Brew.*, B. S. N. H., vi, p. 4; "Mass. in summer;" *Putn.*, p. 206; *Sam.*, p. 7.)

No. 500, ♂. Essex Co. S. Jillson, 1855.
No. 526, ♀. " " " " "

Myiodioides mitratus Audubon. — Hooded Flycatching Warbler. Very rare, and perhaps accidental summer visitant to more southern portions. (Mass., "Very rare; summer," *Sam.*, p. 7; Conn., *All.*, p. 83; New Haven, Ct., *Linsl.*, p. 257.)

The *Muscicapa* or *Myiodioides* "minuta" has been repeatedly attributed to New England. (Berkshire Co., Mass., *Enmons*, *Peab.*, p. 297; *Putn.*, p. 226; Salem, Mass., *Nutt.*, p. 297; Ipswich, Mass., *Brewer*; Mass., "doubtful" *All.*, p. 83.) I think it probable that some one of the small *Empidonaces* has been mistaken for it. M. "minuta" is rather an apocryphal species, with which latter day ornithologists do not profess to be acquainted.

Setophaga ruticilla Swains. — Redstart. Common summer resident. In southern portions chiefly spring and autumn migrant.

No. 524, ♂. Essex Co. S. Jillson, 1855.
No. 525, ♀. " " " " "

TANAGRIDÆ.

Pyrranga rubra Vieill. — Scarlet Tanager. Summer resident, common; less so in more northern portions.

No. 412, ♂. Salem, Essex Co. F. W. Putnam, 1856.
No. 413, ♀. Lynn, " " S. Jillson, June, 1855.

Pyrranga æstiva Vieill. — Summer Tanager. Very rare (probably only accidental), as far north as Massachusetts. (Lynn, Mass., April 21, 1852, S. Jillson, *Putn.*, p. 224; *All.*, p. 83. Stratford and New Haven, Ct.; *Linsl.*, p. 261. Omitted from *Sam. O. O.*)

HIRUNDINIDÆ.

Hirundo horreorum Barton. — Barn Swallow. Abundant summer resident.

No. 480, ♂. Lynn, Essex Co. S. Jillson, 1856.
No. 483, ♀. " " " " "

Petrochelidon lunifrons Cab. — Cliff Swallow. "Eaves Swallow." Abundant summer resident.

Prof. Verrill (B. S. N. H. vol. ix, p. 276, 1863) has recently elucidated some very interesting facts relative to the distribution of this species, substantiating its occurrence in Eastern North America long before the time when it was erroneously supposed to have immigrated from the west. My present belief in the matter is that the Cliff Swallow is, and always has been, amenable to the ordinary laws of migration, and spread over nearly all of North America, the South Atlantic States, perhaps, excepted. The numerous recorded dates of its appearance and breeding in particular localities, merely mark the times when the birds forsook their natural breeding places, and built under eaves, which enabled them to pass the summer where formerly they were unable to breed for want of suitable accommodations.

No. 482, ♂. Lynn, Essex Co. S. Jillson, 1856.

No. 479, ♀. Essex Co. Mr. Houghton, 1848.

Tachycineta bicolor Cab. — White-bellied Swallow. Abundant summer resident.

No. 481, ♀. Lynn, Essex Co. S. Jillson, 1856.

Cotyle riparia Boie. — Bank Swallow. Abundant summer resident.

No. 478. Essex Co. F. W. Putnam, 1854.

Progne subis Baird. — Purple Martin. Common summer resident.

It is very singular that there should be no instances on record of the occurrence in New England of the Rough-winged Swallow, *Stelgidopteryx serripennis*, as the species certainly ought to be found there.

AMPELIDÆ.

Ampelis garrulus Linn. — Bohemian Wax-wing. A very rare visitant from the north in winter, and of very irregular occurrence. Accidental in more southern sections. (Mass., *Peab.*, p. 290; *Putn.*, p. 228; *All.*, p. 66; *Sam.*, p. 7. — Conn., Dr. W. Wood, *All.*, p. 66.)

Ampelis cedrorum Baird. — Cedar Wax-wing. "Cedar

Bird." "Cherry Bird." Resident. Abundant. Breeds throughout, and winters in the more southern portions.

No. 475. Essex Co. S. Jillson, 1855.

No. 564, ♀. " " " " " "

LANIIDÆ.

Collurio borealis Baird. — Butcher Bird. Great Northern Shrike. Regular winter resident, but not very common south of Maine. None have been known to breed.

No. 468, ♂. Lynn, Essex Co. S. Jillson, Dec., 1855.

No. 469, ♀. Salem, " " B. Grover, Autumn, 1860.

No. 470, ♀. Lynn, " " S. Jillson, Winter, 1855.

Collurio excubitoroides Baird. — White-rumped Shrike. Of very doubtful occurrence. (*Emm.*, p. 3; *Peab.*, p. 292; apparently upon the authority of Nuttall (*Man.* ii, p. 564), who may have been mistaken. Not given in more recent lists.) New England is beyond its ordinary range. Still the species is found at Hamilton, Canada West ("Summer resident; not very rare." *McIl.*, p. 87), and very likely may occasionally occur.

No. 1170, Hamilton, Canada West, T. McIlwraith, 1866.

Mr. Putnam gives *C. Ludovicianus* in the appendix of his list, misquoting it for "*excubitoroides*," and giving the authority of the above-mentioned writers for its insertion. *Ludovicianus* is entirely a southern species, and I know of no authentic instance of its straggling into New England. I never found it as far north even as Washington, D. C. Mr. Linsley, however, gives it under the name of "*Lanius Carolinensis*," but upon merely opinionative data.

VIREONIDÆ.

Vireo olivaceus Vieill. — Red-eyed Vireo. Abundant summer resident.

No. 471, ♂. Essex Co. S. Jillson, March, 1855.

Vireo gilvus Bon. — Warbling Vireo. Common summer resident.

Vireo Philadelphicus Cass. — Brotherly Love Vireo.*

* As this species has not yet been christened in the vernacular, I beg leave of Mr. Cassin to bestow upon it the above literal translation of its classical appellation.

A very rare summer visitant throughout New England. (Waterville, Me., *Haml.*, p. 4, only recorded instance.) But it is probably of regular though very rare occurrence.

Vireo solitarius Vieill. — Blue-headed Vireo. Rather rare summer resident. Breeds throughout.

No. 473, ♂. Essex Co. S. Jillson, 1855.

Vireo flavifrons Vieill. — Yellow-throated Vireo. Common summer resident, chiefly in more southern sections. (Waterville, Me., *Haml.*, p. 4; not recorded in other Maine lists.)

No. 474, ♂. Essex Co. S. Jillson, March, 1855.

Vireo Novæboracensis Bonap. — White-eyed Vireo. Summer resident, chiefly of more southern sections; and, singularly enough, very rare in or absent from particular localities. Not recorded in Maine lists. "Not known at Springfield, Mass." (*All.*, p. 67. "Rather common:" Essex Co., Mass., *Putn.*, p. 213.)

No. 472, ♂. Essex Co. S. Jillson, March, 1855.

TROGLODYTIDÆ.

Troglodytes ædon Vieill. — House Wren. — Common summer resident. I do not think it goes much north of New England.

Troglodytes Americanus Aud. — Wood Wren. This is a species recognized by all the local writers, chiefly as a spring and autumn migrant, but probably also breeding. Its relations to *ædon* are very intimate, and the species is by many authors considered as a dubious one. (Omitted from *Sam. O. O.*)

I have in my private cabinet a specimen taken many years ago near Portsmouth, N. H., which was examined by Mr. Audubon himself, and pronounced to be of this species. It is rather larger and browner, and with less of a light superciliary line than the average of *ædon*; but looks very like a House Wren.

Anorthura hyemalis Rennie. — Winter Wren. Not abundant. Chiefly winter resident, but also breeds, at least in northern sections. (Calais, Me., *Boardm.*, p. 126.)

Cistothorus palustris Cab. — Marsh Wren. — Summer

resident: not abundant. Chiefly along the coast. It must be very rare north of Massachusetts, as it is not contained in Maine lists, though it is known to occur in Greenland.

Cistothorus stellaris Cab.—Short-billed Marsh Wren. Rather common summer resident as far north at least as Massachusetts. Not recorded from Maine.

Two other wrens, *Thryothorus Bewickii* and *T. Ludovicianus*, may possibly enter the southern portions of New England in summer. Mr. Lawrence (p. 283) records *T. Ludovicianus* from New York Island.

CERTHIIDÆ.

Certhia Americana Bon.—Brown creeper. Common. Breeds throughout New England, and winters in its more southern districts.

No. 263. Essex Co. S. Jillson, 1855.

PARIDÆ.

Sitta Carolinensis Gmelin.—White-bellied Nuthatch. Resident: abundant.

No. 476, ♂. Essex Co. S. Jillson, Autumn, 1854.

Sitta Canadensis Linn.—Red-bellied Nuthatch. Abundant. Resident. Chiefly a winter visitant in more southern, but breeds plentifully in the northern sections.

No. 477, ♀. Essex Co. S. Jillson, 1855.

Lophophanes bicolor Bon.—Crested Tomtit. Rare and perhaps accidental. The only record of its capture that I have found is the mention of it by Linsley (p. 255). Chiefly a more southern species, but has been found north of New England. (Nova Scotia, *Aud.*, Orn. Biog. v, p. 472.—Near New York., *Lawr.*, p. 283.—Omitted from *Sam. O. O.*)

Pœcile atricapillus Bon.—Black-capped Titmouse. Chickadee. Resident. Abundant.

No. 505, ♂. Lynn, Essex Co. S. Jillson, Nov., 1855.

Pœcile Hudsonicus .—Hudsonian Titmouse. Resident in more northern; an occasional or accidental visitor in winter in the southern sections. ("Breeds." Calais,

Me., *Boardm.*, p. 126, *Verr.*, p. 22.—Mass. in winter; *Peab.*, p. 402; *Putn.*, p. 227; *All.*, p. 83.)

ALAUDIDÆ.

Eremophila cornuta Boie.—Shore Lark. Winter resident. Not abundant. Breeds plentifully in Labrador.

No. 868, ♂. Nahant, Essex Co. S. Jillson, Dec., 1855.

No. 869, ♀. " " " " " " " "

FRINGILLIDÆ.

Pinicola Canadensis Cab.—Pine Grosbeak. Regular winter visitant, and common in Maine. Further south it is rare and occasional. (New Haven, Conn., *Linsl.*, p. 261.)

No. 408, ♂. Essex Co. S. Jillson, July, 1855.

No. 403, ♀. " " " " " " " "

Mr. McIlwraith (p. 88) records the capture of the Evening Grosbeak, *Hesperiphona vespertina* Bon., at Woodstock, Canada.

Carpodacus purpureus Gray.—Purple Finch. Resident, or nearly so. Abundant. Breeds plentifully in more northern portions; and winters more sparingly in the southern.

No. 415, ♂. Essex Co. S. Jillson, Spring, 1855.

No. 418, ♀. " " " " " " " "

Astragalinus tristis Cabanis.—Goldfinch. Abundant. Breeds plentifully; and remains through the winter, except in the more northern regions.

No. 419, ♂. Essex Co. S. Jillson, Summer, 1855.

No. 420, ♂. " " " " Dec., 1855.

Chrysomitris pinus Bon.—Pine Linnet. Abundant and generally distributed, chiefly as summer resident in more northern, and winter resident in more southern, regions. Known to breed in Massachusetts.

No. 421, ♂. Lynn, Essex Co. S. Jillson, Winter, 1854-5.

No. 109, ♂. Chicago, Ill. R. Kennicott, May. From Chicago Academy of Science, 1864.

Egiothus linarius Cabanis.—Lesser Redpoll Linnet. Common. Not known to breed. A winter visitant, of irregular occurrence, sometimes appearing in great numbers.

No. 416, ♀. Essex Co. S. Jillson, 1855.

Ægiothus exilipes Coues. — American Mealy Redpoll. Very rare and occasional winter visitant. This is *Linaria* or *Ægiothus "canescens"* of Audubon's works and of the local lists. I do not think the true *canescens*, from Greenland, occurs.

In addition to the preceding it is very probable that my *Ægiothus fuscescens*, from Labrador, occurs in winter.

Curvirostra Americana Wils. — Red Crossbill. Resident, and abundant, though of irregular and uncertain occurrence. Known to breed at least as far south as Massachusetts. ("Said to breed in winter." Calais, Me., *Boardm.*, p. 126.)

No. 407, ♂. Essex Co. S. Jillson, Winter, 1855.

No. 405, ♀. " " " " " "

Curvirostra leucoptera Wils. — White-winged Crossbill. Resident, and common, though less so than the preceding. In southern portions it is chiefly a winter visitant. ("Resident; breeds in winter;" Calais, Me., *Board.*, p. 126.)

No. 410, ♂. Essex Co. S. Jillson, Winter, 1855.

No. 406, ♀. " " " " " "

Plectrophanes nivalis Meyer. — Snow Bunting. Common winter visitant, but rarely remains all summer in New England. (Breeding; Springfield, Mass., summer of 1862. C. W. Bennett, *All.*, p. 70.)

No. 373. Essex Co. Joshua Cleaves, Nov. 18, 1859.

No. 1171, ♂. Salem, Essex Co. S. Carlen, Jan. 1867.

No. 1172, ♀. " " " " " "

No. 106, adult. Great Slave Lake. From the Chicago Acad., 1864.

Plectrophanes Lapponicus Selby. — Lapland Bunting. Rare winter visitant throughout New England.

No. 372. Essex Co. S. Jillson, 1855.

Chondestes grammacus Swains. — Lark Finch. One instance. Entirely exceptional. (Gloucester, 1845, S. Jillson. *Putn.*, p. 224.)

Passerculus savanna Bon. — Savannah Sparrow. Abundant. Chiefly spring and autumn visitant, but breeds, especially in more northern portions. Probably none winter.

No. 392, ♂. Essex Co. S. Jillson, 1855.

PASSERCULUS "ALAUDINUS" Bon. Western Savannah Sparrow.

I do not think that this supposed species is permanently distinct from the preceding.

No. 104. Great Bear Lake, Arctic America. From the Chicago Academy of Sciences, 1864.

Poecetes gramineus Baird. — Bay-winged Bunting. Grass Finch. Abundant summer resident.

No. 398, adult. Essex Co. F. W. Putnam, 1856.

Coturniculus passerinus Bon. — Yellow-winged Sparrow. Summer resident. Abundant, becoming less common in more northern sections. ("*Fringilla savannarum*?" Peab., p. 324.)

Coturniculus Henslowii Bon. — Henslow's Sparrow. Summer resident, and very rare; not recorded north of Massachusetts. (Springfield, Mass., *All.*, p. 71. Lynn, Mass., *Sam.*, p. 9. Berlin, Mass., E. S. Wheeler, Proc. B. S. N. H. vii, p. 137.)

Zonotrichia leucophrys Swainson. — White-crowned Sparrow. Chiefly spring and autumn migrant. Not known to breed, though doubtless it does so; and some probably winter. Usually common, but of somewhat irregular occurrence.

No. 107. Chicago, Ill., R. Kennicott, May. From the Chicago Academy of Sciences, 1864.

Zonotrichia albicollis Bon. — White-throated Sparrow. Chiefly spring and autumn migrant, though many breed, especially in more northern sections. Abundant. Few, if any, remain through the winter.

No. 397, ♂. Essex Co. S. Jillson, 1856.

Ammodromus maritimus Swains. — Sea-side Finch. Common summer resident as far north as New Hampshire, where I have found it abundant. Not recorded from Maine. It is chiefly a coast species.

Ammodromus caudacutus Swains. — Sharp-tailed Finch. Distribution much the same as that of the preceding.

Junco hyemalis Sclater. — Snow Bird. Abundant. Resident. Chiefly spring and autumn migrant; but breeds plentifully in Maine. Also breeds, but much more sparingly, towards the southern limits, where some also remain all winter.

No. 422, ♂. Essex Co. S. Jillson, 1858.

Spizella monticola Baird.—Tree Sparrow. Abundant. Chiefly spring and autumn migrant; but breeds, rarely at least, as far south as Massachusetts, where many remain through the winter.

Nos. 394, ♂; 399, ♀. Essex Co. S. Jillson, 1858.

No. 105, Anderson River, north of Great Bear Lake, Arctic America.

R. McFarlane. From the Chicago Academy of Sciences, 1864.

Spizella socialis Bon.—Chipping Sparrow. Abundant. Summer resident.

No. 401, ♂. Essex Co. S. Jillson, Spring of 1856.

No. 423, ♀. " " " " Autumn of 1856.

Spizella pusilla Bon.—Field Sparrow. Abundant. Summer resident.

No. 402, ♀. Essex Co. S. Jillson, 1858.

Melospiza melodia Baird.—Song Sparrow. Abundant. Summer resident. I think it will be found to winter in the more southern portions.

No. 391, ♂. Essex Co. S. Jillson, Winter of 1856.

No. 395, ♂. " " " " 1856.

Melospiza palustris Baird.—Swamp Sparrow. Common summer resident. Some probably winter towards the southern limit.

No. 400, ♀. Essex Co. S. Jillson, 1856.

Melospiza Lincolnii Baird.—Lincoln's Sparrow. This is a most extensively distributed species, whose range includes almost the whole continent of North America, and yet it is everywhere of uncommon occurrence. Three instances only of its capture in New England are recorded. (Springfield, Mass., May of 1860, '63, '64. *All.*, p. 73. Omitted from *Sam. O. O.*)

Passerella iliaca Swains.—Fox-colored Finch. Common spring and autumn migrant. Not recorded as either breeding or wintering in New England.

No. 393, ♀. Essex Co. S. Jillson, 1856.

No. 100, Washington, D. C. C. Drexler. From the Chicago Academy of Sciences, 1864.

If the *Passerella obscura* Verrill (*Proc. B. S. N. H.*, ix, 1862, p. 143) be a valid species it undoubtedly visits New England in its migrations.

Pyrqita domestica.—European House Sparrow. Introduced, and at present only found in certain localities,

though it will doubtless before long become generally distributed. All the important circumstances attending the introduction of the species are fortunately on record. See, particularly, *Lawr.*, p. 287; *Proc. B. S. N. H.*, xi, 1867, p. 157, and 1868, p. 389: also "Atlantic Monthly" for 1868.

Euspiza Americana Bon.—Black-throated Bunting. Rare or accidental as far north as Massachusetts, beyond which it is not recorded. ("Mass.," *Nutt.*, i, p. 461; *Emm.*, p. 4; *Peab.*, p. 319; *Putn.*, p. 227; *Sam.*, p. 10; *All.*, p. 84. "New Haven, Conn.; very common;" *Lins.*, p. 261.)

No. 103, ♂. Utah. C. S. McCarthy. From the Chicago Academy of Sciences, 1864.

Guiraca Ludoviciana Swains.—Rose-breasted Grosbeak. Throughout New England in summer. Not abundant, except in particular localities, where it appears to have increased in numbers of late years (*e. g.* Essex Co.; "quite common;" S. Jillson, *Putn.*, p. 212).

No. 411, ♂. Essex Co. S. Jillson, 1856.

No. 409, ♀. " " " " "

Guiraca cœrulea Swains.—Blue Grosbeak. Summer visitant; rare or occasional. As far north, at least, as Calais, Me. (*Boardm.*, p. 127.—Omitted from *Sam. O. O.*)

Cyanospiza cyanea Baird.—Indigo Bird. Summer resident. Not abundant much north of Massachusetts.

No. 424, ♂. Essex Co. S. Jillson, 1856.

No. 417, ♀. " " " " "

Cardinalis Virginianus Bp. Cardinal Grosbeak. Rare and accidental as far north as Massachusetts. Perhaps, as suggested by Mr. Linsley, some of the instances of its occurrence may have been cage-birds which had escaped. (See *Nutt.*, Man. i, p. 519.—Connecticut; *Peab.*, p. 329; *All.*, p. 85.—New York Island, *Lawr.*, p. 286.—Omitted from *Sam. O. O.*)

Pipilo erythrophthalmus Vieill.—Towhee Bunting. Summer visitant. Most abundant in more southern portions.

No. 414, ♂. Lynn, Essex Co. S. Jillson, 1855.

No. 557, ♂, young. Lynn, Essex Co. S. Jillson, July, 1855.

ICTERIDÆ.

Dolichonyx oryzivorus Swains. — Bob-o'-link. Abundant summer resident.

No. 453, ♂, Summer. Essex Co. S. Jillson, 1855.

No. 458, ♀, " " " " " "

No. 459, ♂, Winter. " " " " 1856.

No. 455, ♂, Autumn. " " " " "

Molothrus pecoris Swains. (*Fringilla ambigua* Nutt., and of the earlier local authors.) Cow Bird. Common summer resident.

No. 460, ♂. Essex Co. S. Jillson, 1855.

No. 454, ♀. " " " " "

Agelæus phoeniceus Vieill. — Red-winged Black-bird. Abundant summer resident.

No. 448, ♂. Essex Co. S. Jillson, 1856.

No. 466, ♀. " " " " "

Sturnella magna Swains. — Field-lark. Resident, but most abundant in summer, as the greater number leave during the winter. "Southern Maine in summer; not common" (*Verr.*, p. 22). Probably does not go much farther north.

No. 461, ♀. Essex Co. S. Jillson, 1856.

No. 98. Peoria, Ill. F. Blschoff. From the Chicago Academy of Sciences, 1864.

Icterus Baltimorensis Daudin. — Baltimore Oriole. "Golden Robin." Abundant summer resident.

No. 446, ♂. Essex Co. S. Jillson, 1855.

No. 447, ♀. " " " " "

Icterus spurius Bon. — Orchard Oriole. Summer resident. Rare; and probably not extending to the northern limits.

Scolecophagus ferrugineus Swains. — Rusty Grackle. Common, chiefly during the migrations; but it breeds in northern sections, and some probably winter.

No. 449, ♂; immature. Lynn, Essex Co. S. Jillson, Sept. 1855.

No. 450, ♂; " " " " " 1856.

Quiscalus versicolor Vieill. — Purple Grackle. Common summer resident.

No. 451, ♂. Lynn, Essex Co. S. Jillson, Sept., 1855.

No. 452, ♀. " " " " "

Quiscalus major Vieill. — Boat-tailed Grackle. En-

tirely accidental, in summer ; but has been known to breed. (Cambridge, Mass., *Sam.*, p. 10 ; *All.*, p. 85.) This is the *Quiscalus "baritus"* of Peabody (p. 285), and of Linsley (p. 260 ; "New Haven ; one specimen"). (Omitted from *Sam. O. O.*)

CORVIDÆ.

Corvus carnivorus Bartram. — Raven. Resident, and not uncommon in more northern sections. "Breeds on cliffs at Grand Menan" (*Boardm.*, p. 127). Accidental, or at least unusual towards the southern limits. (Springfield, Mass., 1859 ; *All.*, p. 75. Quite common on the New Jersey coast, *Lavr.*, p. 289.)

Corvus Americanus Aud. — Crow. Abundant. Resident, except, perhaps, towards the extreme north in the depth of winter.

No. 456, ♀. Beverly, Essex Co. F. W. Putnam, 1868.

No. 457. Essex Co.

Corvus ossifragus Wils. — Fish Crow. A rare summer visitor, chiefly along the more southern portions of the coast.

Cyanura cristata Swains. — Blue Jay. Abundant. Resident. Mostly retires from the extreme north in mid-winter.

No. 465, ♀. Essex Co. S. Jillson, 1855.

Perisoreus Canadensis Bon. — Canada Jay. "Whiskey-Jack." Chiefly a winter visitant from the north. Very rare, and only occasional farther south than Maine. Mr. Boardman (p. 127) gives it as resident, and breeding about Calais, Me. (Mass., *Putn.*, p. 228. Not given by Mr. Samuels nor Mr. Allen, as a bird of the State. Near Manhattanville, N. Y. Island, in midsummer, *Lavr.*, p. 289.)

COLUMBIDÆ.

Ectopistes migratorius Swains. — Wild Pigeon. Common. Exceedingly abundant at irregular intervals. Breeds. Not known to winter.

No. 528, ♂. Essex Co. S. Jillson.

Zenædura Carolinensis Bon.—Dove. Summer resident. Common in more southern, rare in the northern regions.

No. 527, ♂. Essex Co. S. Jillson, 1855.

TETRAONIDÆ.

Tetrao Canadensis Linn.—Spruce Partridge. Resident, if not abundant, in more northern sections. Uncommon, as far south as Massachusetts. "A common resident near the Umbagog Lakes" (*Verr.*, p. 17). "Resident. Common. Breeds" (Calais, Me., *Boardm.*, p. 128). "Hemlock woods of Gloucester, Sept., 1851" (S. Jillson, quoted by *Putn.*, p. 224, and *All.*, p. 85). Not given by Samuels as a Massachusetts bird.

No. 864, ♀. Maine. S. Jillson, 1855.

No. 866, ♂. " " " "

No. 865, ♂. " R. Brookhouse, Feb., 1856.

Bonasa umbella Steph.—Ruffed Grouse. Common. Resident.

This is the "Partridge" of New England, but known as the "Pheasant" farther south, where the *Ortyx Virginianus* is known as the Partridge. The latter is the "Quail" of New Englanders.

No. 871, ♂. Essex Co.

Nos. 868-69-70, ♀. Essex Co.

Cupidonia cupido Baird.—Pinnated Grouse. "Prairie Hen." This species is still known to reside in certain localities in New England, though much less numerous than formerly, and doubtless destined shortly to become extinct. (Long Island, Martha's Vineyard, Naushon, etc.) Mr. Peabody (p. 355) says they were "once very common in New England," but that "the only place where they are now (1839) found in Massachusetts is in Martha's Vineyard, and one small island near it." Mr. Allen says (p. 85), "nearly extinct in Massachusetts. A few are still occasional visitors in the south-eastern part of the State, from Long Island, where they still remain." Mr. Samuels says (p. 11), "only found on Martha's Vineyard and Naushon." Not recorded farther north. (Examine also: *Emm.*, p. 4; *Lins.*, p. 264; *Putn.*, p. 229;

Nutt., Man. p.; *Aud.*, Orn. Biog., ii, p. 490; *Aud.*, B. Am., v, p. 93; *Cabot*, Proc. B. S. N. H., v, p. 154.)

Nos. 861, 867, ♂. Illinois. Dr. William Mack, Aug., 1845.

No. 862, ♀. Illinois. N. Vickary, May, 1860.

PEDICEETES COLUMBIANUS Elliot. — Sharp-tailed Grouse. (*P. phasianellus* Baird, nec Linn.)

No. 863, ♂. Winter. Boston Market. Probably from Illinois. S. Jillson, Jan., 1856.

CENTROCERCUS UROPHASIANUS Swains. — Sage Cock. Cock of the Plains.

No. 95. Colorado Mts., west of Denver City. D. Thompson. From the Chicago Academy of Sciences, 1864.

The Wild Turkey, formerly abundant, is now generally believed to be nearly or quite extinct. As long ago as 1839, Mr. Peabody tells us, it had become very rare. At the present day it is given by some Massachusetts authorities, and not by others. Mr. Allen "can find no authentic instance of its recent capture in this State, although it has been said to occur wild on Mts. Tom and Holyoke." As Mr. Allen judiciously hints, we must take care not to confound the domesticated Turkey run wild with the true *M. gallopavo*. The former may always be recognized by the conspicuous whitish tips of the feathers of the rump and upper-tail coverts, which are like those of the *M. Mexicana* Gould. Mr. Samuels omits the species. Mr. Putnam gives it, but entirely upon the authority of the older writers. It is contained in none of the Maine lists. Mr. Linsley wrote of it in 1843, "the last Wild Turkey that I have known in Connecticut was taken . . . about thirty years since, on Letoket Mountain, in Northford."

PERDICIDÆ.

Ortyx Virginiana Bon. — Quail. — Resident, as far north as Massachusetts. Not very abundant, and apparently rapidly becoming less numerous. Not recorded in the Maine lists.

No. 858, ♂. Essex Co.

No. 857, ♀. " "

Lophortyx Californicus Bon. — California Plumed

Quail. Of exceptional and entirely accidental occurrence, and not really entitled to a place in the list, as the specimens captured were doubtless cage-birds. ("Bridgeport, Ct., Dec., 1840"; *Lins.*, p. 264.)

LAGOPIDÆ.

Lagopus albus Aud. — White Ptarmigan. Rare, in winter, in more northern portions. Hardly known as a straggler so far south as Massachusetts. ("Northern Maine, in winter; rare;" *Verr.*, p. 22. — Omitted from *Sam. O. O.*)

No. 860. White plumage. Manchester, Essex Co., May 10, 1859; but supposed to have been brought alive from Labrador or Newfoundland and escaped.

No. 76, ♀. Summer plumage, Sukkertoppen, Greenland, July 30, 1862. From the Williams College Lyceum, 1864.

No. 94. White plumage. Great Slave Lake. R. Kennicott. From the Chicago Academy of Sciences, 1864.

I am not confident that these three specimens are of the same species; or that *albus* is their proper name.

GRUIDÆ.

GRUS CANADENSIS Temm. — Sand-hill Crane.

Nos. 1034; 1035. Bloomington, Ill. Dr. E. S. L. Richardson.

The Whooping Crane, *G. Americanus*, has been attributed to New England by one author. (*Emm.*, p. 5; and quoted by *Putn.*, p. 229.) No recent writers present it. Its occurrence must be regarded as extremely problematical.

ARDEIDÆ.

Ardea herodias Linn. — Great Blue Heron. "Blue Crane." Summer resident. Common.

No. 996, ♂. Essex Co. J. Webster, 1856.

No. 997, ♂, young. Essex Co.

No. 464, ♀. Newburyport, Essex Co.

Herodias egretta Gray. — Great White Egret. Rare summer visitant; hardly farther north than Massachusetts. No part of New England is within its regular range; and its occurrence must be considered accidental,

though recorded in several instances. (*E. g. Putn.*, p. 218; *All.*, p. 76. — Omitted from *Sam. O. O.*)

Garzetta candidissima Bon. — Snowy Heron, or Little White Egret. Stragglers only as far north as Massachusetts. "Spring: very rare" (Essex Co., Mass., *Putn.*, p. 218). "Boston, 1862"; (*All.*, p. 86.)

Florida cærulea Baird. — Little Blue Heron. Accidental as far north as Massachusetts. "Very rare. Summer visitor." (*Sam.*, p. 11.) "Stragglers taken." (*All.*, p. 86. — Omitted from *Sam. O. O.*)

Ardetta exilis Gray. — Least Bittern. Very rare in summer, as far as Southern Maine. (*Verr.*, p. 22.)

No. 88. Chicago, Ill. H. O. Snow. From Chicago Acad. Sci., 1864.

Botaurus lentiginosus Steph. — Bittern. Common summer resident throughout New England. This is one of the few Herons found as far north as Labrador.

No. 999. Essex Co. R. Brookhouse, 1856.

No. 1000. " "

Butorides virescens Bon. — Green Heron. Common summer resident throughout New England.

No. 1021. Essex Co.

No. 1022, young. Essex Co.

Nyctiardea Gardenii Baird. — Night Heron. "Qua-bird." "Squawk." Very abundant summer resident. There are extensive "heronries" of this species at Wenham and Rowley, and also at Camden, Mass., though fast becoming things of the past.

No. 998, young; first plumage. Rowley, Essex Co. H. P. Ives, 1854.

No. 993. Essex Co.

No. 994. Salem, Essex Co. L. J. Johnson, April 16, 1852.

No. 995. " " " B. S. Grover, 1854.

No. 996, ♀, young. Essex Co. Amos Prince, May 30, 1866.

The Yellow-crowned Night Heron, *Nyctherodius violaceus*, may also occur. The Louisiana Heron, *Demigretta Ludoviciana*, has been detected as far north as New York (*Laur.*, p. 292), and may occasionally straggle into New England, though I know of no record of its occurrence.

Falcinellus Ordii Bon. — Glossy Ibis. Has been occasionally taken as far north as Massachusetts, but its appearance must be regarded as exceptional. (*Emm.*, p. 5; *Peab.*, p. 365; *Lins.*, p. 266; *Putn.*, p. 230; *All.*,

p. 86; *Cabot*, B. S. N. H., iii, pp. 313, 333, 355; iv, p. 346; *Nutt.*, Man. ii, p. 88; *Lawr.*, p. 292. — Omitted from *Sam. O. O.*)

IBIS RUBRA Vieill. — Scarlet Ibis. Nos. 990, 991, from Brazil. The claims of this species to a place in the Fauna of the United States rest upon insufficient evidence.

The White Ibis (*I. alba*) sometimes strays along the coast to New York (*Lawr.*, p. 292), and may reach New England.

CHARADRIIDÆ.

Charadrius Virginicus Borck. — Golden Plover. Spring and autumn migrant. Abundant.

No. 1014, young. Essex Co.

No. 1015. Cape Cod, Mass. S. Jillson, Sept., 1854.

Ægialitis vociferus Cass. — Kildeer Plover. Summer resident; common, but somewhat irregularly distributed.

Ægialitis semipalmatus Cab. — Ring Plover. Spring and autumn migrant. Usually abundant. A few probably breed.

No. 1016. Essex Co. S. Jillson, 1855.

No. 1018. " " " " "

Ægialitis melodus Cab. — Piping Plover. Summer resident. Many breed on the islands and along the coast. Most abundant, however, during its migrations.

No. 1017, ♂. Essex Co. Dr. H. K. Oliver, 1853.

Ægialitis Wilsonius Cass. — Wilson's Plover. Appears to be rather rare, and perhaps only occasional, as far north as Massachusetts. I do not find it recorded from Maine. Dr. Brewer's authority for its abundance at Nahant, in August, 1838, is the one usually quoted. Samuels, however, says (p. 11) "common in spring and fall," which is at variance with the statements of most observers. Recorded from Stratford, Ct. (*Lins.*, p. 265.) The species really belongs to a more southern region.

Squatarola helvetica Cuvier. — Black-bellied Plover. Spring and autumn migrant. Not ordinarily very abundant.

No. 1008. Spring. Essex Co. A. Houghton, 1836.

No. 1010. Fall. " " " " "

No. 1011. Winter. " " " " "

No. 1012, ♂, young. Cape Cod, Mass. S. Jillson, Sept. 1854.

HÆMATOPODIDÆ.

Hæmatopus palliatus Temm. — Oyster Catcher. Of very unusual occurrence, along the coast. (Mass., T. M. Brewer. *Peab.*, p. 358; *Emm.*, p. 5; *Putn.*, p. 230; *All.*, p. 86.)

Strepsilas interpres Illig. — Turnstone. Spring and autumn migrant. Not common.

No. 1019. Essex Co.

No. 1020, ♂, young. Nahant, Essex Co. S. Jillson, Sept. 1855.

RECURVIROSTRIDÆ.

Recurvirostra Americana Gm. — Avoset. Very rare, and perhaps accidental. (Calais, Me., one instance, spring of 1862. *Boardm.*, p. 128; *Verr.*, p. 22. — Mass., *Emm.*, p. 5; *Putn.*, p. 230; *All.*, p. 86.)

Himantopus nigricollis Vieill. — Black-necked Stilt. Very rare and perhaps only accidental. (Calais, Me., spring of 1862, one instance. *Boardm.*, p. 128; *Verr.*, p. 22. — Mass., *Emm.*, p. 5; *Peab.*, p. 358; *Putn.*, p. 230; *All.*, p. 86. — Omitted from *Sam.*, O. O.)

The ordinary range of both the preceding species is more southern and western. But Mr. Lawrence (p. 295) has found them near New York.

PHALAROPODIDÆ.

Steganopus Wilsonii Coues. — Wilson's Phalarope. Very rare, perhaps only accidental, and chiefly during its migrations. (*Putn.*, p. 227; *All.*, p. 86, quoting Audubon's authority; *Lawr.*; p. 295; omitted from *Sam.*, O. O.)

Phalaropus fulicarius Bon. — Red Phalarope. Rare or occasional along the coast, during its migrations. (*Lawr.*, p. 295; omitted from *Sam.*, O. O.)

Lobipes hyperboreus Cuv. — Northern Phalarope. Not abundant. Chiefly spring and autumn migrant; but Mr. Verrill thinks some may breed off the coast of Maine.

This is probably the species spoken of by Mr. Boardman, as very common in the Bay of Fundy.

No. 1050. Essex Co. S. Jillson, 1856.

SCOLOPACIDÆ.

Scolopax rusticola Linn. — European Woodcock. This species is authenticated as occurring on our coast from Newfoundland to New York, as a straggler from Europe. Examine in this connection *Lawr.*, p. 292, and *Baird*, *Am. Journ. Sci. and Art*, xli, 1866, p. 25.

Philohela minor Gray. — Woodcock. Abundant summer resident.

No. 1040, ♀. Essex Co.

Gallinago Wilsonii Bon. — Snipe. Common. Chiefly during its migrations; but many breed, especially in the more northern sections.

No. 1044. Essex Co. Dr. H. K. Oliver, December, 1853.

Macrorhamphus griseus Leach. — Red-breasted Snipe. Seen chiefly while migrating; but some breed in the more northern sections. "Summer visitant." (*Calais, Me., Boardm.*, p. 128.)

The *M. scolopaceus* *Lawr.*, is undoubtedly to be added to the list. New York market, March 20th; *Lawr.*, p. 294.

Calidris arenaria Illiger. — Sanderling. Abundant. Chiefly spring and autumn migrant, but perhaps permanent resident. I know that some winter on the New Hampshire coast; and Mr. Verrill (p. 23) gives it as abundant on the Maine coast in summer.

No. 1026. Essex Co.

No. 1027, ♀. Essex Co. R. Waters, August, 1858.

Tringa canutus Linn. — Knot. Ash-colored or Red-breasted Sandpiper. Abundant. Spring and autumn migrant along the coast. Some doubtless winter.

No. 1040. Essex Co. S. Jillson, 1855.

No. 1047, young. Essex Co. S. Jillson, 1855.

Arquatella maritima Baird. — Purple Sandpiper. On the coast in spring, autumn, and winter. Not very uncommon. Not known to breed.

Ancylocheilus subarquatus Kaup. — Curlew Sandpiper. Very rare; seen chiefly during its migrations. The species is in America hardly more, perhaps, than a visitor from Europe.

The four preceding *Tringæ* are essentially maritime, rarely quitting the immediate vicinity of the sea.

Pelidna Americana Coues. — American Dunlin. Red-backed or black-bellied Sandpiper; (*Tringa alpina* of early writers). Abundant. Chiefly spring and autumn migrant, but some winter.

Actodromas maculata Cass. — Pectoral Sandpiper. "Jacksnipe;" "Grass Snipe;" (*Tringa pectoralis* Say, and early writers). Common during the migrations, particularly in the autumn.

No. 1046, ♀. Essex Co. S. Jillson, 1856.

Actodromas minutilla Coues. — Least Sandpiper. "Peep." Very abundant during its migrations. Chiefly maritime, but very generally distributed.

No. 1025. Essex Co. Dr. H. K. Oliver, 1853.

No. 91. Spanish Town, Jamaica. W. T. March. From the Chicago Academy of Sciences, 1864.

Actodromas Bonapartei Cass. — Bonaparte's Sandpiper. White-rumped Sandpiper. "*Tringa Schinzii*" of earlier authors. A very common and widely distributed species, whose range includes nearly all of North America, at least east of the Rocky Mountains. They are exceedingly abundant in Labrador toward the end of summer; and I have found them equally numerous in Kansas Territory, in May, while migrating northward. They breed in very high latitudes, and are only found in New England, so far as I am aware, during their migrations.

No. 1028. Essex Co. Dr. H. K. Oliver, 1853.

No. 1048. " " S. Jillson, 1855.

No. 1049. " " " " "

Ereunetes pusillus Cass. — Semipalmated Sandpiper. "Peep." Abundant. Spring and autumn migrant. Not known to breed. Some may winter. Chiefly maritime.

No. 1024. Essex Co. Dr. H. K. Oliver, 1853.

No. 90, Spanish Town, Jamaica. W. T. March. From the Chicago Academy of Sciences, 1864.

The Stilt Sandpiper, *Micropalama himantopus*, may be confidently expected to occur; but I cannot refer to any recorded instances of its capture. Mr. Lawrence includes it in his New York list.

The original of *Tringa Cooperii*, Baird, was shot on

Raynor South, L. I., May 24, 1833, and should be included in this list, although I am not aware that any one has seen or heard of any specimens except the type upon which the species was based. Mr. Lawrence gives it a place in his list. Cf. *Baird*, B. N. A., p. 716, and *Coues*, Pr. A. N. S. Philad., 1861, p. 202.

An extralimital species of Sandpiper, *Tringa platyrhyncha*, now *Eurinatorhynchus pygmaeus*, is inserted by Peabody (p. 367) in the Massachusetts list, on the authority of Mr. S. Cabot, Jr., "who procured a specimen at Nahant." If this instance be authentic, it is the only one on record of the occurrence of the species in North America.

Symphemia semipalmata Hartl. — Willet. Summer resident. Not very abundant.

No. 1039. Essex Co. S. Jillson, 1855.

No. 1040. " " " " "

Gambetta melanoleuca Bon. — Tell-tale. Stone Snipe. Common. Chiefly spring and autumn migrant; but doubtless breeds in more northern portions.

No. 89. Spanish Town, Jamaica. W. T. March. From the Chicago Academy of Sciences, 1864.

Gambetta flavipes Bon. — Yellow-legs. Common spring and autumn migrant. Probably breeds in the more northern portions. (*Verr.*, p. 17.)

No. 1033. Essex Co. Dr. H. K. Oliver. Spring, 1853.

No. 1045. " " S. Jillson. Autumn, 1855.

Rhyacophilus solitarius Baird. — Solitary Sandpiper. Not very abundant. Chiefly spring and autumn migrant. Mr. Samuels (p. 12) gives it as breeding in Massachusetts.

No. 1028, ♀. Essex Co. S. Jillson, October, 1855.

Tringoides macularius Gray. — Spotted Tatler. "Tip-up." "Teeter-tail." Abundant summer resident.

No. 1029, nestling. Essex Co. Dr. H. K. Oliver, 1853.

No. 1031, nestling. Essex Co. S. Jillson, 1855.

No. 1032, young. " " " " "

No. 1030, adult. " " " " "

Actiturus Bartramius Bon. — Bartram's Tatler. "Field Plover." Common. Summer resident; but most abundant during its migrations.

No. 98. Chicago, Ill. R. Kennicott. From the Chicago Academy of Sciences, 1864.

Tryngites rufescens Cab. — Buff-breasted Sandpiper. Very rare spring and autumn migrant.

Philomachus pugnax Gray. — Ruff. Accidental. From Europe. Several instances of its capture at various points on the New England coast. It is now generally included among North American birds. (Calais, Me., "accidental, one or two instances;" Boardman, *Verr.*, p. 23. Near New York; *Lawr.*, p. 294. Long Island; *Baird*, B. N. A., 1858, 727, etc. Omitted from *Sam. O. O.*)

Limosa fedoa Ord. — Marbled Godwit. Not common, and only during its migrations.

No. 1038, ♀. Essex Co.

Limosa Hudsonica Swains. (*Limosa Edwardsii?* of *Linsl.*, p. 267; perhaps an albino.) — Hudsonian Godwit. Rare, and only during its migrations.

No. 1051, ♀, young. Essex Co. S. Jillson, 1855.

Numenius longirostris Wils. — Long-billed Curlew. "Sickle-bill." Not abundant, and only during its migrations.

No. 992. Essex Co. S. Jillson, 1855.

Numenius Hudsonicus Lath. — Hudsonian Curlew. Rare, and only during its migrations.

Numenius borealis Lath. — Esquimaux Curlew. Spring and autumn migrant. It is singular that this species should not be abundant in New England, considering the almost incredible numbers that take their departure for the south from Labrador in early autumn.

In addition to the preceding *Totuinæ*, the *Totanus glottis* Bechst. (*Glottis Floridana* Bp.) has been accredited to Connecticut by Mr. Linsley (p. 266; Stratford; one instance); but very possibly through an erroneous identification.

RALLIDÆ.

Rallus elegans Aud. — Fresh Marsh Hen. Rare, perhaps accidental, in summer, in the more southern portions. (Stratford, Ct. *Linsl.*, p. 267.)

Rallus crepitans Gm. — Salt Marsh Hen. Accidental summer visitor, as far north as Massachusetts. (*Cabot*,

B. S. N. H. iii, p. 326; *Putn.*, p. 229; *Sam.*, p. 12; *All.*, p. 87.)

No. 1006, ♂. Florida. N. C. Robbins, 1854.

Rallus Virginianus Linn.—Virginia Rail. Summer visitant. Not very abundant. Known to breed as far north as Maine.

No. 1009. Ipswich. Essex Co. R. Brookhouse, September, 1858.

No. 1013. Essex Co.

Porzana Carolina Vieill. — Sora Rail. "Ortolan." Common summer resident. Less abundant in more northern portions.

Nos. 1008, 1004. Essex Co. S. Jillson, 1854.

No. 92. Spanish Town, Jamaica. W. T. March. From the Chicago Academy of Sciences, 1864.

Porzana Novæboracensis Cass. — Yellow Rail. Very rare, in summer, as far north as Massachusetts. (*Emm.*, p. 6; *Peab.*, p. 375; *Linsl.*, p. 268; *Putn.*, p. 229; *Sam.*, p. 12; *All.*, p. 87.)

Nos. 1005, 1007. Ipswich. Essex Co. R. Brookhouse, Sept., 1857.

Fulica Americana Gm. — Coot. Summer resident. Not uncommon. Breeds; but appears to be everywhere most numerous during the migrations.

Nos. 1001, 1002, ♂. Essex Co.

Gallinula galeata Bon. — Common Gallinule. Accidental as far north as Massachusetts. (Cambridge, Mass., Cabot. *Peab.*, p. 258; *All.*, p. 87.)

Gallinula martinica Lath. — Purple Gallinule. Very rare and accidental summer visitor. ("Swampscott, Mass., April 22, 1852; S. Jillson;" *Putn.*, p. 224; *All.*, p. 87.) Neither this nor the preceding species is alluded to by Mr. Samuels.

ANATIDÆ.

Cygnus Americanus Sharpless.—Swan. (? *C.* "*musicus* Bp." *Linsl.*, p. 268.) Of irregular, or at most very rare occurrence, in winter.

Anser hyperboreus Pallas.—Snow Goose. Rare winter visitant along the whole coast.

If the *Anser coerulescens*, usually believed to be the young of the Snow Goose, be really a valid species, it should take its place in the list of New England birds.

Anser Gambelii Hartl.—American white-fronted Goose. Very rare, and perhaps accidental, in winter. (Omitted from *Sam.*, *O. O.*)

No. 1109. Bloomington, Ill. Dr. E. S. L. Richardson.

Bernicla leucopsis. — Barnacle Goose. This European species has been repeatedly attributed to New England. (Quincy, Mass., *Cab.*, B. S. N. H., iii, p. 136; *Putn.*, p. 225; *All.*, p. 88; Stonington, Conn., *Linsl.*, p. 269.) Its occurrence in North America, a long time considered doubtful, has recently been established. (*Am. Nat.*, ii, 1868, p. 49.)

Bernicla Canadensis Boie. — Wild Goose. Spring and autumn migrant. Abundant.

Bernicla Hutchinsii. — Hutchins' Goose. Chiefly spring and autumn migrant. Not abundant. (Omitted from *Sam.*, *O. O.*)

Bernicla brenta Steph. — Brant. Spring and autumn migrant. Common.

The Black Brant, *Bernicla nigricans* Lawr., is undoubtedly to be found in New England. (Long Island, *Lawr.*, p. 296.)

Anas boschas Linn. — Mallard. Winter resident. Not abundant.

No. 1120, ♂. Essex Co.

Anas obscura Gm. — Black Duck. Resident. Breeds plentifully in more northern portions. One of the most abundant species.

No. 1121, ♂. Essex Co.

No. 1126, ♂. " " S. Jillson, 1855.

Dafila acuta Jenyns. — Pintail Duck. Winter resident, chiefly along the coast. Not abundant.

No. 1129, ♂. Essex Co. S. Jillson, 1855.

Nettion Carolinensis Baird. — Green-winged Teal. Common spring and autumn migrant. Not recorded as breeding.

Nos. 1114, 1135, ♂. Essex Co. S. Jillson, 1856.

No. 1115, ♀. " " " " " "

Nettion crecca Kaup. — English Teal. A European species, but so often taken on the coast as to be fairly considered as more than an accidental visitor. (Omitted from *Sam.*, *O. O.*)

Spatula clypeata Boie. — Shoveller. Spring and autumn migrant. Uncommon.

No. 1111, ♂. Essex Co. S. Jillson, 1856.

Querquedula discors Steph. — Blue-winged Teal. Spring and autumn migrant. Common.

No. 1082, ♂. Essex Co.

No. 1118, ♀. " "

Chaulelasmus streperus Gray. — Gadwall. Chiefly in spring and autumn, but some winter. Not abundant.

No. 1130, ♂. Essex Co. S. Jillson, 1855.

Mareca Americana Steph. — Widgeon. Baldpate. Autumn, winter and spring. Common.

No. 1122, ♂. Essex Co. S. Jillson, 1855.

No. 1188, ♂. Chesapeake Bay. R. Brookhouse, 1867.

No. 85. Spanish Town, Jamaica. W. T. March. From the Chicago Academy of Sciences, 1864.

Mareca Penelope Bon. — European Widgeon. A European species, like *N. crecca*, so often taken on our coast as to properly be entitled to a place in our Fauna. (Long Island; apparently breeding; *Brew.*, B. S. N. H., vi, p. 419.) Mr. Samuels says: "Rare in spring and fall" in Massachusetts. Mr. Lawrence has it in his list. (Omitted from *Sam.*, *O. O.*)

Aix sponsa Swains. — Summer Duck. Summer resident. Not very abundant.

No. 1112, ♂; 1183, ♀. Wenham, Essex Co. John J. Gould, 1868.

No. 1113, ♀. Essex Co. S. Jillson, 1855.

Fulix marila Baird. — Scaup Duck. Winter resident, though most plenty during the migrations. Not very abundant.

No. 1083, ♂. Essex Co. S. Jillson, 1855.

Fulix affinis Baird. — Little Blackhead. Chiefly spring and autumn migrant. Some may winter. Uncommon.

No. 86. Spanish Town, Jamaica. W. T. March. From the Chicago Academy of Sciences, 1864.

Fulix collaris Baird. — Ring-necked Duck. Chiefly spring and autumn migrant. Some may winter. Not common. (Omitted from *Sam.*, *O. O.*)

No. 87. Chicago, Ill. Prof. McChenesy. From the Chicago Academy of Sciences, 1864.

Aythya Americana Bon. — Red-head. Winter resident, but more abundant during its migrations.

Aythya vallisneria Bonap.—Canvass Back. Chiefly winter resident. Not abundant.

No. 1185, ♂. Chesapeake Bay. R. Brookhouse, 1867.

Bucephala Americana Baird. Golden-eye. Common winter resident.

No. 1181, ♀. Essex Co. S. Jillson, 1855.

Bucephala Islandica Baird. Barrow's Golden-eye. There can be no doubt that this species, at least occasionally if not regularly, visits the whole of New England. It is recorded from the St. Lawrence, and as far south as New York City. Its only record from New England, so far as I am aware, is Calais, Me., "winter, very rare;" (*Boardm.*, p. 129.) For some interesting notes concerning it, see *Elliot*, Ann. Lyc. N. H. N. Y., vii, Jan., 1862.

Bucephala albeola Baird.—Buffle Head. Butter Ball. Abundant. Winter resident.

No. 1103, ♂. Essex Co. S. Jillson, 1855.

No. 1104, ♀. " " " " " "

Histrionicus torquatus Bon.—Harlequin. Rare winter visitant along the coast. Known to breed, rarely, on the islands in the Bay of Fundy (*Boardm.*, p. 130).

Harelda glacialis Leach.—Long-tailed Duck. Common winter resident.

No. 1123, ♂, summer. Essex Co. S. Jillson, 1856.

No. 1080, ♂, winter. " " " " 1855.

No. 1117, ♀, " " " " " "

Camptolæmus Labradorius Gray.—Labrador Duck. Rare winter visitant. (Omitted from *Sam.*, O. O.)

Melanetta velvetina Baird.—Velvet Duck. White-winged "Coot." Common winter resident, chiefly along the coast.

No. 1119, ♂. Essex Co. A. F. Bosson.

Pelionetta perspicillata Kaup.—Surf Duck. Abundant winter resident.

No. 1099. Essex Co.

Edemia Americana Swains.—Scoter. Common winter resident.

No. 1100, ♂. Essex Co.

No. 1116, ♀. " " A. F. Bosson.

No. 291, young. Chesapeake Bay. R. Brookhouse, Nov., 1867.

Somateria mollissima Leach. — Eider Duck. Common on the whole coast during the winter, spring, and autumn. They chiefly retire farther north to breed, though some remain all summer "on the islands of the Bay of Fundy" (*Verr.*, p. 24).

No. 1125, ♂, immature; nearly black all over, with a pure white breast. Essex Co. S. Jillson, 1855.

No. 79, ♀, adult. Sukkertoppen, Greenland, July 30, 1860. From the Williams College Lyceum of Natural History, 1864.

Somateria spectabilis Leach. — King Eider. Rare winter visitant along the coast.

No. 1124, ♀. Essex Co. S. Jillson, 1856.

Erismatura rubida Bon. — Ruddy Duck. Common during its migrations, and many winter. Perhaps some breed in more northern portions.

No. 188. South Salem, Essex Co. Emery S. Johnson, Nov. 7, 1866.

Mergus Americanus Cass. — Sheldrake. Common during the migrations, and in winter. Some may breed?

No. 1084, ♂. Essex Co.

No. 1085, ♀. " "

Mergus serrator Linn. — Red-breasted Merganser. Common during its migrations and in winter. It is said to breed as far south as Massachusetts by Audubon.

No. 1081, ♀. Essex Co.

No. 1184, ♂. Salem, Essex Co. H. B. Griffin, 1867.

Lophodytes cucullatus Reich. — Hooded Merganser. Winter visitant in more southern portions; "a few breed in the northern part;" (of Maine; *Verr.*, p. 24.) Nowhere very common.

No. 1186, ♂. Lake Champlain. Dr. B. Pickman, 1866.

No. 1187, ♀. " " " " " "

The Smew, *Mergellus albellus* Selby, has been inserted in Massachusetts lists, but probably upon erroneous data. Its occurrence in America is very problematical.

SULIDÆ.

Sula bassana Briss. — Gannet. Common. Resident in the northern, winter visitant to the more southern, portions of the New England coast.

No. 1101, ♂, adult. Essex Co. A. Houghton, 1836.

No. 1102, young. " " S. Jillson, Summer, 1856.

Sula fiber Linn. — Booby. "September. Rare." (Es-

sex Co., Mass., *Putn.*, p. 221; Guilford, Conn., *Lind.*, p. 271.) A species recorded, as above, but by no other writers, so far as I can learn. Its occurrence is entirely exceptional.

PELECANIDÆ.

Pelecanus trachyrhynchus Lath. — American White Pelican. ("*P. erythrorhynchus*" of Gmelin, which name conveys an erroneous impression regarding it, and should be rejected.) Accidental. One instance of its recent capture in New England. (Calais, Me., *Boardm.*, p. 130.) The habitat of this species seems to have changed greatly since the accounts of the earlier authors were penned. New England lies much without its ordinary range as now recognized.

PHALACROCORACIDÆ.

Graculus dilophus Gray. — Double-crested Cormorant. Not uncommon along the coast during the winter.

Graculus carbo Gray. — Common Cormorant. Shag. Common winter visitant along the coast.

No. 1195, Immature. Off Gloucester, Essex Co. C. J. Maynard, Jan., 1867.

PHÆTONIDÆ.

PHÆTON FLAVIROSTRIS Brandt. — Tropic Bird. (*Lep-
turus candidus* Briss.; *Phæton æthereus*, Audubon, B. Am., vii, p. 64, pl. 427; *P. flavirostris* Brandt, Bull. Acad. St. Petersb. i, 1837, p. 349; Lawrence, B. N. A., 1858, p. 884.) A specimen, No. 1087, agrees with the descriptions and figures here cited, and should undoubtedly bear the above name.

No. 1087. South Atlantic. H. F. Shepard, 1856.

PHÆTON ———? Another excellent specimen in the collection differs much from the former, and appears to be of a different species. It is much larger, with a bright vermilion bill, and with the back finely mottled with black and white. I do not know the proper name of this species, unless it is the true *æthereus* of Linnæus, as con-

tradistinguished by Brandt and others from *candidus* Briss.

No. 1086, ♂. South Atlantic. H. F. Shepard, 1856.

PROCELLARIIDÆ.

DIOMEDEA EXULANS Linn.—Wandering Albatross. Numerous examples of this species, all from extra-limital localities (No. 1134, and others).

PHŒBETRIA FULIGINOSA Reich. — Dusky Albatross. Several specimens from extra-limital regions.

[NOTE. In addition to the preceding species, I find several examples of *D. culminata* Gould, chiefly from Cape Horn. No. 1127 and others. One of these is peculiarly interesting. The plumage indicates it to be nearly mature; but yet the bill is wholly pure black, with only a slight brownish tinge along the sides of the inferior maxillary ramus. There is not the slightest trace of yellow on the culmen. This is the first example I have ever met with in this condition. The specimen is now in the Smithsonian Institution. This is the species given by Audubon as *D. "chlororhyncha,"* of which he says his specimen was taken not far from the Columbia River.]

Fulmarus glacialis Leach.—Fulmar Petrel. A rare winter visitant along the coast. (*Peab.*, p. 383; *Putn.*, p. 231; *All.*, p. 89. Omitted from *Sam.*, *O. O.*).

DAPTION CAPENSIS Steph.—Pintado Petrel. Of this species, usually accorded a place among North American Birds, a specimen (No. 1142) is in the collection from Cape Horn.

PRIOFINUS CINEREUS Coues.—Cinereous Petrel. (Not the Atlantic "Cinereous Shearwater" which is the *Puffinus Kuhlii* Boie. Not "*Puffinus cinereus*" of the earlier American authors, which is *P. major* Faber, *infra*. See my review of the *Procellariidæ*, Pr. A. N. S., Phila., Apr. 1864, p. 119, for synonymes and relationships.) A fine example of this species in the collection (No. 1145) from Cape Horn. It is a very extensively distributed species.

Puffinus major Faber.—Greater Shearwater. "Hagdon." (*Puffinus "cinereus"* of the earlier local lists.) Not uncommon off the coast, particularly in winter. This is the most abundant species off the north-east coast of America. (Omitted from *Sam.*, *O. O.*)

No. 1141. Salem, Essex Co. J. A. Goldthwait, Sept. 25, 1854.

Puffinus Anglorum Temm.—Mank's Shearwater. Of not uncommon occurrence off the coast, chiefly in winter. (Omitted from *Sam.*, *O. O.*)

Puffinus fuliginosus Strickl. — Sooty Shearwater. "Black Hagdon." Common off the coast, except in summer. (Omitted from *Sam.*, *O. O.*)

The whole group of the dusky unicolor Petrels are certainly foremost among the "opprobria ornithologiæ;" remaining a standing rebuke that at this late date so little should be accurately known concerning them. The question whether this, and certain other birds composing the genus *Nectris* of Forster, as amended by Bonaparte, are valid species, or only seasonal or sexual conditions of the bicolor *Puffini*, is still agitated. There cannot be the slightest doubt that there are species of Petrels remaining uniformly dusky all through their lives; e. g. *P. sphenurus* Gould, *P. carneipes* Gould, *Æstelata fuliginosa* Coues ex Kuhl, *Majaqueus æquinoctialis* Bon. ex Linn., etc. But that certain of the *Puffini* do not at some period during their progress towards maturity, or afterwards, at some seasons, pass through or acquire a dusky state of plumage, is by no means incontrovertibly proven. For example, I have a strong suspicion that the specimen upon which I based my *Puffinus creatopus* (Pr. A. N. S. Phila., 1864, p. 131), a bicolor individual, was, a few months before its death, in a uniformly fuliginous state of plumage. Argument from analogy is readily forthcoming. Witness the well-known immature states of plumage of *Æstelata Lessonii*, *Æ. Cookii*, *Æ. mollis*, *Ossifraga gigantea*, *Diomedea exulans*, etc., etc., of the *Procellariidæ*; or, in another family, the species of *Stercorarius*; all of which species pass through, or acquire at times, different plumages, one of which is fuliginous. Let one attempt to study *Procellariidæ*, and he will find, amid a few pretty definitely ascertained facts, an immense mass of heterogeneous, indigestible data, affording ample ground for speculative hypotheses, which are incapable alike of proof or denial, since the key-note whereby they may be harmonized has not as yet been struck.

Procellaria pelagica Linn. — Stormy Petrel. (*Thalassidroma pelagica* Vigors, and most authors.) Of irregular and somewhat rare occurrence off the coast. (Omitted from *Sam.*, *O. O.*)

Oceanites oceanica Coues. — Wilson's Petrel. (*Thalassidroma Wilsonii* of authors.) Common off the coast. I find no recorded instances of its breeding, although most probably it does so. It is a cosmopolitan species.

No. 1138, ♀. Salem Harbor, Essex Co. Capt. B. B. Neal, August, 1855.

Cymochorea leucorhoa Coues. — Leach's Petrel. (*Thalassidroma Leachii* of authors.) Resident. The most abundant Petrel, being of very common occurrence along the whole coast. "Breeds abundantly from Mount Desert to Grand Menan" (*Verr.*, p. 24). Accidental in the interior. (Springfield, Mass., *All.*, p. 80.)

LARIDÆ.

Buphagus Skua Coues. — Skua Gull. ("*Lestris cataractes*" of authors.) Said to be of very rare or accidental occurrence along the coast as far north as Massachusetts (*Peab.*, p. 381). But it is not given in any of the recent lists, and its occurrence is extremely problematical.

Stercorarius pomarinus Temm. — Pomarine Jäger. Along the coast in winter; not abundant. Known to proceed as far south, at least, as Pennsylvania. It is oftener seen farther north.

Stercorarius parasiticus Gray. — Arctic Jäger. Not rare off the coast in winter. Most numerous in the more northern portions of the continent.

This is the *Lestris Richardsonii* of Audubon, and of the earlier American writers; but not the species or variety so named by Swainson. The true *Richardsonii*, as I have defined it (*Pr. A. N. S.*, Phila., 1863, p. 121), may possibly visit New England in winter.

Stercorarius Buffonii Coues. — Long-tailed Jäger. "Marlingspike." (*S. cepphus* Gray, and authors generally.) Common off the coast in autumn and winter. (Omitted from *Sam.*, *O. O.*)

Larus marinus Linn. — Great Black-backed Gull. "Saddle-back." "Coffin-carrier." Winter visitant. Not abundant. "A few breed." (Bay of Fundy, *Boardm.*, p. 131.)

No. 1095, ♂, adult. Essex Co. S. Jillson, 1856.

No. 1096, ♂, young. " " " " " "

Larus glaucus Brünn. — Glaucous Gull. "Burgomaster." "Ice-Gull." Very rare winter visitant. (Omitted from *Sam.*, O. O.)

Larus leucopterus Faber. — White-winged Gull. Winter visitant. Not abundant. (Omitted from *Sam.*, O. O.)

Larus Smithsonianus Coues. — American Herring Gull. "*L. argentatus*" of American authors. Resident. Abundant in winter along the whole coast. Breeds in numbers on the islands off the coast of Maine.

No. 1094, adult. Essex Co. C. D. Saunders, April, 1854.

No. 1189. Salem Harbor, Essex Co., Dec. 28, 1867. By purchase.

Larus Delawareensis Ord. — Ring-billed Gull. Common off the coast in winter. Some breed. (Omitted from *Sam.*, O. O.)

Larus Hutchinsii Richardson. (*Coues*, Pr. Acad. Nat. Sc. Phila., 1862, p. 294.) — Hutchins' Gull. Snow-white Gull. I am much pleased to find in the collection an excellent example of this species of Richardson's, which I have recently revived, as above. The specimen agrees entirely with others in the Smithsonian Institution from various localities, upon which I based the species. The bird is rather smaller than *glaucus*, and pure white all over, including the wings; the shafts of which are yellowish. On the upper tail coverts and scapulars are some very faint, nearly obsolete transverse bars of light grayish brown. On the under tail coverts these bars are somewhat better defined. The plumage of the breast and belly has a slight clouding of grayish, doubtless, with the bars above mentioned, indicative of immaturity. The bill is yellow, its terminal third black. The legs and feet appear to have been dusky flesh-color.

We can avoid recognizing this bird as a valid species upon only two hypotheses. One is, that it is an albino;

but that such is the case is purely a matter of conjecture, and would be an exchange of one doubtful opinion for another. The other is, that it is an immature stage of *L. glaucus*. The color of the bill and some other features tend to confirm this latter supposition. I am somewhat familiar with the "theory of variation" which obtains among Gulls during their progress toward maturity; but do not now recollect an instance in which the bluish pearl of the upper parts of those species, which, like *glaucus*, finally attain this color, is not apparent at an age evidently reached by the specimen in question. Moreover, if such a state of plumage as that just described is a normal stage of *glaucus* during its adolescence, it is rather singular that I should have met with no description of such a condition in my tolerably thorough study of Larine bibliography. For the present, therefore, I continue to give credence to the existence of a large pure white gull, for which I have adopted the above name; being prepared, however, in view of the extreme uncertainty of all matters ornithological, and especially Larine, to retire from my position when the first good evidence of its unsoundness is presented.

No. 1132. Essex Co. S. Jillson, 1856.

[NOTE. The *Larus fuscus* is given by Peabody (p. 380) as found off the coast of Massachusetts, and by Linsley (p. 271) as from Stonington, Conn. These are, doubtless, erroneous identifications. There is no good evidence of the occurrence of this European species on our coasts.]

Chærocephalus atricilla Lawr.—Laughing Gull. Resident. Not abundant. "A few breed about the islands." (Bay of Fundy, *Boardm.*, p. 131.) Winters sparingly along southern portions of the coast.

No. 1106, young. Essex Co. S. Jillson, 1856.

Chærocephalus Philadelphia Lawr.—Bonaparte's Gull. Common; resident, except perhaps during the breeding season. By no means confined to the coast.

No. 1107, young. Essex Co. S. Jillson, 1853.

Rissa tridactyla Bon.—Kittiwake. Common winter resident. Some probably breed off the coast of Maine.

No. 1105, young ♂, winter. Essex Co. S. Jillson, 1854.

No. 1108, adult. Essex Co. Dr. H. K. Oliver, 1854.

The Fork-tailed Gull, *Xema Sabinii* Leach, doubtless

occurs as a rare winter visitant. (Near New York, *Lawr.*, p. 299.)

Gelochelidon Anglica Bon. — Marsh Tern. (*Sterna aranea* of American authors.) Of rare and perhaps only accidental occurrence, in summer. (*Emm.*, p. 5; *Putn.*, 231; *Sam.*, p. 14; *All.*, p. 90.)

Thalasseus Caspius Boie. — Caspian Tern. A rare winter visitant. "Coast in winter; rare." (Maine, *Verr.*, p. 25.) It is known to go considerably farther south. Mr. Lawrence has it in his New York list.

No. 1194. No locality; a fine example of my var. *imperator*.

Thalasseus acutiflavus Coues. — American Sandwich Tern. Of undoubted occurrence in summer on the coast; although I do not now recall a record of its capture.

Mr. Peabody (p. 378) gives the "*Sterna cayana*" (of Audubon = *regius* Gamb.) as a Massachusetts bird, but entirely upon the statement of Audubon, that he saw it in Labrador. But Audubon doubtless mistook *Caspius* for it. Still I am of opinion that *regius* does sometimes wander as far north as New England. (Near New York, *Lawr.*, p. 299.)

Sterna hirundo Linn. — Common Tern. Summer resident, breeding abundantly along the coast.

No. 1088, young, ♂. Essex Co. Dr. H. K. Oliver, 1853.

No. 1092 (probably) " " " " " "

No. 1090, 1091, immature. Essex Co. S. Jillson, 1854.

No. 78, fledgling, July 24. Sukkertoppen, Greenland. Williams College Lyceum of Natural History, 1864. Either this or the succeeding species.

Sterna macroura Naum. — Arctic Tern. Abundant. Resident, breeding and wintering.

No. 1089, ♀. Essex Co. C. L. Pierson, 1853.

No. 1093. " " " " " "

Sterna paradisea Brünn. — Roseate Tern. Common on the coast in summer, as far north as Massachusetts. "Breeds plentifully on Muskeget Island, in company with *S. hirundo*, *macroura*, and *Antillarum*." (*All.*, in *epist.*) The species has usually been held to be rare or accidental. (Omitted from *Sam.*, O. O.)

Sterna Antillarum Coues. — Least Tern. Summer resident. Common. Some breed.

Sterna Forsterii Nutt. — Forster's Tern. A species which I do not find recorded, though undoubtedly occur-

ring in winter. In the plumage of that season it constitutes Audubon's *Sterna "Havellii."* Mr. Lawrence has specimens from Long Island. It is decidedly a northern species, probably not breeding within our limits.

Hydrochelidon fissipes Gray.—Short-tailed Tern. Rare and perhaps occasional, chiefly in the latter part of summer, and early in autumn.

Haliplana fuliginosa Wagl.—Sooty Tern. A rare and perhaps only accidental summer visitant as far north as Massachusetts. "Breeds on Muskeget Island." (E. A. Samuels, *All.*, p. 90. Omitted from *Sam.*, *O. O.*)

Rhynchops nigra Linn.—Black Skimmer. Entirely accidental, if really occurring. (Mass., *Emm.*, p. 6; *Linsl.*, p. 271; *Putn.*, p. 231; not recognized by other local authorities.)

COLYMBIDÆ.

Colymbus torquatus Brünn.—Loon. Common; resident. "Occasionally breeds." (Mass., *Sam.*, p. 14; *All.*, p. 80.) Regularly breeds in more northern portions. In southern portions is chiefly found during the winter.

No. 1097, adult. Essex Co. S. Jillson, May, 1864.

No. 1098, young. " " " " 1853.

Colymbus arcticus Linn.—Black-throated Loon. Very rare winter resident. Not known to breed. (Omitted from *Sam.*, *O. O.*)

Colymbus septentrionalis Linn.—Red-throated Loon. Rare winter visitant.

No. 80, adult, Sukkertoppen, Greenland, July 30, 1860. Williams College Lyceum of Natural History, 1864.

No. 1190, young. Salem, Essex Co. A. F. Bosson, 1863.

No. 1191, ♀. " " " Saml. Carlen, Nov., 1866.

No. 189, ♂. " " " J. H. Emerton, Nov. 7, 1866.

Colymbus ———? Unidentifiable.

No. 77, nestling. Sukkertoppen, Greenland, July 31, 1860. Williams College Lyceum of Natural History, 1864.

PODICIPIDÆ.

*Podiceps Holböllii** Reinhardt. (*P. rubricollis* or *gri-*

* See my Review of the Loons and Grebes of North America, in the Proc. A. N. S., Phila., 1862, p. 226.

seigena of American writers.)—Red-necked Grebe. Common. Chiefly winter resident, but some doubtless breed.

No. 1147, ♀. Essex Co. William Patterson.

No. 1150, " " " " A. F. Bosson.

Podiceps cristatus Lath. — Crested Grebe. Common winter resident. Some breed in Maine. (Calais, *Boardm.*, p. 131.)

Podiceps cornutus Lath. — Horned Grebe. Common winter resident. But many breed, particularly in more northern portions.

No. 1148, young ♀. Essex Co. A. F. Bosson.

No. 1149, " " " " " "

Podilymbus podiceps Lawr. — Dabchick. Common; resident, but chiefly occurs in spring and fall.

No. 1444, ♀. Essex Co. R. Brookhouse.

ALCIDÆ.

The Great Auk, *Alca impennis*, formerly existed in New England. For an interesting account of the discovery, by Prof. Wyman, of its remains at Mt. Desert, and at Crouch's Cove, Me., see *Am. Nat.*, i, p. 578. Audubon states that it used to occur on the coast of Massachusetts.*

Uta mania torda Leach. — Razor-billed Auk. "Tinker." Chiefly a winter visitant, and common. Resident in more northern portions, breeding about the Bay of Fundy. (*Boardm.*, p. 131; *Verr.*, p. 25.)

No. 83, adult. Labrador. Williams College Lyceum of Natural History, 1864.

Fratereula arctica Ill. — Puffin. "Sea Parrot." Chiefly a winter visitant, and not uncommon. Some breed about the Bay of Fundy. (*Boardm.*, p. 131; *Verr.*, p. 25.)

No. 81. Caribou Isl., Lab. Williams College Lyceum of Natural History, 1864.

The Large-billed Puffin, *F. glacialis*, has been accredited to Grand Menan, by Audubon, and included, upon his authority, in some of the local lists. But its occurrence is at best extremely problematical. (Cf. my mon-

* This statement has been corroborated by the finding of a humerus of the Great Auk in the Shell-heaps at Ipswich, by Prof. Baird, in August last. — F. W. P.

ograph of the Alcidae, p. 24.) Audubon's "glacialis" is the *corniculata* Naum., a North Pacific species, not recorded from the Atlantic.

Lunda cirrhata Pallas. — Tufted Puffin. Said to be of very rare occurrence in winter off the coast of Maine. Near Calais, Me., (*Boardm.*, p. 132; *Verr.*, p. 25. Grand Menan. Audubon. Omitted from *Sam.*, O. O.)

Uria grylle Lath. — Black Guillemot. "Sea Pigeon." Resident in more northern portions, breeding abundantly on the rocky islands; a common winter visitant along more southern portions of the coast.

No. 1189, ♀, winter. Nahant, Essex Co. S. Jillson, Dec., 1855.

No. 1146, winter. " " " " " "

No. 1140. Essex Co. By purchase, 1864.

No. 82, summer. Labrador. Williams College Lyceum of Natural History, 1864.

Lomvia troille * Brandt. (*Colymbus troille* L. Gm. — *Uria troille* Lath., and most European writers:—*Catarrhactes troille* Bryant. — *Cephus lomvia* Pallas. — *Uria lomvia* Brünnich; and of Cassin, in Baird's B. N. A., p. 913. — *Uria troile*, Putn., p. 222. Not of Giraud, B. L. I., p. 376. — *Uria lomvia*, Sam., p. 14; Aud., pl. 218, fig. 2. — Not the *Alca lomvia* Linn. — American and European bird considered identical.) — Common winter resident. Some breed, towards the northern portions. ("Murre Ledges," *Boardm.*, p. 131).

Lomvia ringvia Brandt. (*Uria ringvia* Brünnich, and *U. alga* Brünnich; — *leucophthalmus* Faber, *leucopsis* Brehm, *lachrymans* Choris., and some European writers; *troile* of Giraud's Birds of Long Island, p. 376; Audubon's pl. 218, fig. 1.) — This is the species, or variety, with the white ring around, and white line behind, the eye. Winter visitant; probably some breed with the preceding species.

* The three North American species of *Lomvia* have been so often confounded, and their synonymy is in such a state of confusion, that to enable one to know what species is referred to under a given name, it is absolutely necessary to introduce some synonymes. The reader is referred to my Monograph of the Alcidae, Proceedings of the Philadelphia Academy of Natural Sciences, Jan., 1868, for further information upon the subject. Dr. Bryant's excellent monograph of the genus *Catarrhactes*, in the Proceedings of the Boston Society of Natural History for 1861, should also be consulted.

Lomvia Svarbag Coues.—Brünnich's Guillemot. (*Alca lomvia*, Linn.—*Catarrhactes lomvia* Bryant.—*Uria troille* and *Svarbag*, Brünn. Not *troille* of Linnæus. *Cepphus arra*, Pallas. *Uria arra*, or *Uria Brünnichii* of most authors." Putn., p. 222; Cassin, B. N. A., p. 914. *Uria Francsii* Leach, Giraud, p. 377; Peab., p. 400.)—The thick-billed species, figured by Audubon, pl. 345. Common winter resident. Found as far south as New Jersey. Not known to breed within the limits of New England. (Omitted from *Sam.*, O. O.)

Nos. 1143, 1192, winter. Essex Co.

Mergulus alle Vieill.—Sea Dove. "Dovekie." Common winter resident. Not known to breed within the limits of New England.

Nos. 191, 1136, 1137, adults, winter. Essex Co.

A D D E N D A .

Strix pratincola Bon.—Barn Owl. This rather southern species has only recently been authenticated as occurring in New England. "The first and only specimen I ever knew taken in New England was killed near Springfield, Mass., about the last of May, of the present year." (J. A. ALLEN, MS.) Mr. Lawrence includes it in his New York list.

Turdus nævius Gm.—Varied Thrush. This Pacific species has at length been authenticated as a straggler in New England. "A specimen was shot near Boston in December, 1864." (J. A. ALLEN, MS.) For other instances of its occurrence in the Atlantic States, see *Baird*, B. N. A., pp. xxi, 219; *Cabot*, Proc. B. S. N. H., iii, p. 17; *Allen*, p. 82; *Lawrence*, p. 281.

Mr. Allen informs me that he has carefully examined the specimen of supposed *Turdus nanus*, recorded by Mr. Samuels (*Am. Nat.*, ii, p. 214), and found it to be only an unusually small, bright colored, immature example of *T. Swainsonii*!

Hesperiphona vespertina. Add to the record of this species at Woodstock, Canada, Mr. Lawrence's notice of

its occurrence near New York. Stragglers will probably in time be found in New England.

The Golden Eagle (*Aquila Canadensis*) has been known to breed in Franconia, N. H. (*Dr. Brewer.*)

I am indebted to Mr. Allen for the following memoranda:—

Carpodacus purpureus.—Now not at all rare in southern New England in summer.

Passerculus savanna.—Found breeding plentifully all along the Massachusetts coast; not yet observed in summer in the Connecticut valley.

Coturniculus Henslowii.—Several late instances of its capture in Massachusetts. It seems to be a regular but rare summer visitant. Several nests have been found.

Zonotrichia leucophrys.—Hardly to be considered, Mr. Allen thinks, as "usually common."

Junco hyemalis.—Breeds plentifully in certain localities among the mountains of western Massachusetts.

Spizella monticola.—No authentic instance of its breeding in Massachusetts. The record of its breeding (*Proc. B. S. N. H.*, v, 213,) proves to be erroneous. Mr. Samuels informed Mr. Allen that the nest and eggs there referred to really belonged to *S. socialis*.

Melospiza melodia.—Has been observed in winter at Cambridge, Mass.

M. palustris.—Mr. Allen has not seen this species in Massachusetts except during its migrations.

M. Lincolnii.—Mr. S. Jillson has taken this species at Hudson, in May, 1867.

Cardinalis Virginianus.—Four specimens were taken at one time at Springfield, two or three years since.

Squatarola helvetica.—A few straggling individuals were seen in June on the coast of Massachusetts; but the species is not properly to be considered as a summer resident.

Arquatella maritima.—A few individuals of this species, and also of *Rhyacophilus solitarius*, *Actodromas Bonapartei*, and *A. minutilla*, were seen in June and July

along the coast of Massachusetts; but none of them appeared to be breeding.

Mergus Americanus, *M. serrator*, and *Lophodytes cucullatus*, all breed in Maine as far south as Umbagog Lakes, where eggs and young have been procured. Mr. Allen thinks that Audubon had good grounds for his statement that *M. Americanus* breeds in Massachusetts.

ERRATA.

Page 266, under *Turdus Pallasii*, for No. 562 read 552.

Page 273, under *Dendræca pîna*, for No. 82 read 1197, and for No. 510, ♂, read 510, ♀.

Page 279, under *Certhia Americana*, for No. 263 read 363.

Page 284, under *Pipilo erythrophthalmus*, for No. 557 read 567.

Page 293, under *Philohela minor*, for No. 1040 read 1042.

Page 295, under *Symphemia semipalmata*, for 1040 read 1041.

XIII. *Synopsis of the Polyyps and Corals of the North Pacific Exploring Expedition, under Commodore C. Ringgold and Capt. John Rodgers, U. S. N., from 1853 to 1856. Collected by Dr. Wm. Stimpson, Naturalist to the Expedition.*

BY A. E. VERRILL.

PART IV. ACTINARIA. With three Plates.

[Continued from p. 50.]

THE collection made by Dr. Stimpson, contains a large number of species of *Actinidæ*, preserved remarkably well in alcohol. A large proportion of them are also accompanied by descriptions of the colors and forms while living, and many by colored drawings. Without such descriptions and drawings it would be impossible to describe most of the species in a manner sufficiently complete to make them recognizable. These original drawings have also furnished the figures reproduced upon the accompanying plates.

It is, therefore, but right to say that the following pages are quite as much the work of Dr. Stimpson as of the present author.

In most cases where there are neither notes nor drawings made from the living specimens, I have thought it best either to mention the species by a generic name only, or to omit them altogether, rather than to burden the science with indeterminable species, already far too numerous in this interesting group.

ORDER, ACTINARIA.

Actinaria (pars) Dana, Zoöphytes, 1846.

Actinaria and *Antipatharia* Edwards and Haime, 1857.

Actinaria Verrill, these Proceedings, Vol. IV, p. 147, April, 1865.

This order was sufficiently characterized in Part I, of this series, to serve the purposes of a brief synopsis like the present.

SUBORDER, ZOÄNTHACEA Verrill, Vol. IV, p. 147.

Polyps elongated, attached permanently by the base or by stolon-like expansions of the sides; simple or increasing by basal budding. Walls but little muscular, contracting by involution of the summit.

FAMILY, ZOANTHIDÆ Dana.

Zoanthina Ehr., Corallenthiere des rothen Meeres, p. 45, 1834.

Zoanthina (subfamily) Edwards and Haime, Coralliaires, p. 298, 1857.

Zoanthina (pars) Duch. et Mich., Corall. des Antilles, 1860.

Zoanthidæ Verrill, Mem. Boston Soc. Nat. Hist., Vol. I, p. 34, 1864.

Polyps attached by the base, budding from stolons and membranous expansions from the base. Integument subcoriaceous, or parchment-like, often encrusted with sand. Tentacles marginal, short.

Several species belonging to this family are in the collection, but are not accompanied by notes or drawings.

ZOANTHUS, sp.

Polyps clustered, turbinated, .35 of an inch in height, and .06 in diameter, when contracted in alcohol. Surface striated.

Loo Choo Islands. Dr. Wm. Stimpson.

ZOANTHUS, sp.

Polyps elongated, enlarged at the summit, connected at the bases by slender stolons. Surface sulcated by numerous longitudinal lines, and encrusted by a thin layer of fine coral sand. Height 1 inch; diameter .20.

Loo Choo Islands. Dr. Wm. Stimpson.

PALYTHOA, sp.

Polyps united laterally nearly to the summits, forming broad, encrusting masses, half an inch thick. Polyps, in

contraction, forming prominent verrucæ, covered with fine, agglutinated sand.

Diameter of polyps .25 inch.

Loo Choo Islands. Dr. Wm. Stimpson.

The suborder, *Antipathacea*, is not represented in the collection.

SUBORDER, ACTINACEA. See Vol. IV, p. 148.

FAMILY, CERIANTHIDÆ Edw. and Haime.

Ilyanthidæ (pars) Gosse, *Actinologia Britanica*, p. 227.

CERIANTHUS ORIENTALIS Verrill, these Proceedings, Vol. IV, p. 151, 1865.

Column much elongated, tapering to the base, forming around itself a loose tube of mud agglutinated by a mucous secretion. "Tentacles long and slender, not retractile; inner ones dark purple-brown; outer ones transparent yellowish white, spotted with pale brownish on their inner surfaces, and greenish at the base. In a variety, often seen, the inner tentacles are grass-green. Body of a deep reddish brown color."

This is a large species which, according to Dr. Stimpson, agrees perfectly in habits and the structure of its tube with *C. Americana* V. of Charleston, S. C., living buried to its tentacles in mud.

It is rather sluggish in its habits, and will bear rough handling or agitation of the mud near it before retracting into its tube. This movement, however, when the animal is alarmed, is sufficiently quick. On ordinary occasions it slowly retracts into its tube.

Hong Kong, China, on muddy flats at low water mark. Dr. Wm. Stimpson.

CERIANTHUS STIMPSONII Verrill, these Proceedings, Vol. V, p. 50, 1866.

Plate 1, figures 7, 7a.

Column slender, elongated, tapering to the slender

base; margin simple. The outer tentacles are slender and moderately long, arranged in a single row around the margin. The inner tentacles are very short and small, forming a circle immediately around the mouth. Tube soft, composed of coral sand.

Color pale reddish brown on the lower part of the column, white near the summit. Outer tentacles whitish, distantly annulated with brown, and with black spots at their inner bases. Inner tentacles white.

Length of column, in specimen drawn, 1.25 inches; breadth .18; length of outer tentacles .44.

Port Lloyd, Bonin Islands, dredged in ten fathoms, coral mud, in "ten-fathoms hole," October, 1854. Dr. Wm. Stimpson.

FAMILY, ILYANTHIDÆ.

Ilyanthidæ (*pars*) Gosse, *Actinologia Britannica*, p. 227.

Ilyanthidæ Verrill, *Memoirs Boston Soc. Nat. Hist.*, Vol. I, p. 26.

Column elongated, tapering or rounded at the base, which is destitute of a distinct disk. Tentacles marginal, usually in a single row.

HALOCAMPA BREVICORNIS Verrill.

Edwardsia brevicornis Stimpson, *Proceedings Philadelphia Academy of Natural Sciences*, 1855, p. 376.

Halocampa brevicornis Verrill, *these Proceedings*, Vol. IV, p. 151, 1865.

Plate 3, figures 2, 2a, 2b.

Column slender, elongated, vermiform, tapering toward the obtuse base, changeable in form during life, and often exhibiting moving undulating constrictions, as in *Holothurians*. The twenty internal, radiating lamellæ show through the walls as longitudinal lines. Tentacles twenty, short, thick, with a constriction near the tips, which are enlarged and rounded or capitate.

Body pale brown with a few flake-white spots on the sides. Tentacles dark brown, banded with white at the constriction near the end.

Length one inch; diameter .18.

Ly-ce-moon Passage, near Hong Kong, China, dredged in twenty-five fathoms, shelly gravel, April, 1854. Dr. Wm. Stimpson.

HALOCAMPA CAPENSIS Verrill, these Proceedings, Vol. IV, p. 151, 1865.

Plate 3, figure 3.

Column elongated, rather slender, subvermiform, contracting by the involution of the summit. The twenty internal lamellæ show through the side-wall, and the spaces between them are sub-papillose toward the upper part of the body. Tentacles twenty, oblong, enlarged toward the tips, which are obtusely rounded.

Color pale reddish, with flake-white dots and patches. Inner side of tentacles flake-white; six of the tentacles (perhaps more) have the lower part of their inner surface of a dark brown color, which gives the appearance of ocelli at their bases.

Length in life, .5 of an inch; diameter, .12.

Simon's Bay, Cape of Good Hope, twelve fathoms, sand, October, 1853. Dr. Wm. Stimpson.

"Its actions are Holothurian-like. Its base is rather small and perhaps provided with an opening, since a filament protruded therefrom during a contraction of the animal."—W. S.

HALOCAMPA STIMPSONI Verrill, sp. nov.

Plate 3, figure 1.

Column cylindrical, rather short, with a rounded base. The twenty internal lamellæ appear through the wall as longitudinal lines. Tentacles twenty, alternately longer and shorter, with a constriction near the tips, beyond which they regain their former size, tips obtusely rounded.

Color yellowish white; tentacles with a flake-white spot on the middle of the knob, from which a median white line extends along the inner side of the tentacle to the ring around the mouth.

False Bay, Cape of Good Hope, twenty fathoms, gravel, October, 1853. Dr. Wm. Stimpson.

EDWARDSIA CRETATA Stimpson, Proc. Phil. Acad. Nat. Sci., 1855, p. 376.

Vol. VI, plate 1, figures 1, 1a, 1b.

Body cylindrical, vermiform, in the unexpanded state short in proportion to the breadth. The column is mostly covered by a brownish epidermis, which is encrusted by a layer of fine black sand, the grains of which are but slightly adherent and may be easily rubbed off; upper part naked, slightly ribbed, and with alternately narrower and broader stripes of chalk-white. Tentacles about thirty, slender, nearly as long as the diameter of the disk, pointed, the inner ones longest, mostly black, with a series of white spots along the inner side; a few smaller ones are of a pale gray color. Disk blackish; mouth orange within.

Length, in partial contraction, about .5 inch; diameter .25.

Kagosima Bay, Japan, in five fathoms, black sand, January, 1855. Dr. Wm. Stimpson.

The only specimen preserved is so contracted as to conceal the base by involution, and, as Dr. Stimpson neither described nor figured the base, it is probable that he had no opportunity to see it with the base extended. It is possible that it belongs properly to *Phellia*. But its general appearance, its tentacles, and its habits indicate that it is a true *Edwardsia*.

FAMILY, ACTINIDÆ.

Actinina Ehr. Corallenthiere des rothen Meeres, p. 31, 1834.

Actinidæ (subfamily) *pars*, Edwards and Haimé; Duch. et Michelotti, Corall. des Antilles.

Actinidæ Verrill, Memoirs Bost. Soc. Nat. Hist., Vol. I, p. 15, 1864.

Body more or less cylindrical in expansion. Base with a distinct, flat, muscular, locomotive disk. Tentacles all simple, mostly in many marginal or sub-marginal rows,

but often encroaching more or less upon the disk, the primary cycles being nearest the mouth, and largest.

Column contractile, smooth or tuberculated, perforate or imperforate.

SUBFAMILY, ACTININÆ Verrill, op. cit. p. 15.

Family, *Actiniadæ* Gosse, *Actinologia Britanica*, p. 171, 1860.

Tentacles submarginal, elongated, slender, margin of the column at the outer bases of the tentacles surrounded by a circle of brightly colored, roundish tubercles, which correspond, apparently, with the so-called eye-spots of *Acalephs*, etc.

ACTINIA (*pars*) Linn. ; Edw. and Haime, etc.

Column smooth, having neither lateral pores, suckers, nor verrucæ. Tentacles and disk highly contractile. Colored tubercles in a single marginal row.

ACTINIA (?) TIMIDA Verrill, sp. nov.

Base enlarged, adherent to shells; tentacles cylindrical, blunt, wholly retractile, exterior ones with slight bulb-like projections at their outer bases.

Color of body fawn-colored, striped with dark green; outer tentacles whitish, shaded once or twice with flake-white; marginal or basal bulb with flake-white sides; inner tentacles, near their bases, mottled with brown, yellow, and flake-white, with clear spots looking like holes.

Hong Kong harbor, common on a gibbous *Nassa* in the third region of the littoral zone, in sandy mud and pebbles, February, 1855. Dr. Wm. Stimpson.

This is a very sensitive species, contracting at the slightest disturbance. Its position in this genus is quite doubtful.

SUBFAMILY, ANTHEINÆ Verrill, op. cit. p. 15.

Family, *Antheadæ* (*pars*) Gosse, Actin. Brit. p. 148, 1857.

Family, *Discosomæ* (*pars*) Duch. and Mich., Supl. Corall. Ant. p. 27, 1864.

Column smooth, destitute of verrucæ and lateral pores (cinclidæ). Tentacles usually very long, the inner ones longest, not capable of contracting in length, or but slightly so.

It seems necessary to restrict this group, if it be retained at all, to those genera agreeing essentially with *Anemonia* Risso (*Anthea* Johns.), by excluding *Aiptasia* Gosse, which has a perforated wall and projects acontia, agreeing, therefore, with the *Sagartiniæ*; and those verrucose species like "*A. pustulata* Dana," referred here by Gosse, but belonging rather with *Bunodiniæ*. Should the marginal tubercles of *Comactis* prove to be of the same nature as those of *Actinia*, there would no longer appear to be sufficient reasons for separating the two subfamilies, which might be united under the name of *Actininiæ*. At present the only positive character that can be given for this division is the non-contractility of the disk and tentacles, a character that is found, also, in most of the other groups, and in various degrees of perfection.

PARANTHEA Verrill, gen. nov.

Dysactis Verrill, Revis. Polyps, East Coast U. S., in Mem. Bost. Society, Vol. I, p. 26, 1864, (non Edw. and Halme).

Column subcylindrical, usually short, smooth. Tentacles not contractile, unequal, the inner ones several times longer than the diameter of the body, outer ones much shorter. Disk usually flat, not contractile.

Type, *P. pallida* Verrill, Carolina coast.

PARANTHEA MINUTA Verrill.

Dysactis minuta Verrill, these Proceedings, Vol. 5, p. 50, 1866.

Plate 1, figure 4.

Body very small; column low, subcylindrical, scarcely

higher than broad, smooth; the margin with small, low, rounded prominences between the radiating internal lamellæ. Tentacles very unequal, those of various lengths somewhat intermixed; the inner ones very long and slender, moderately long and stout when partially contracted in alcohol; marginal tentacles much smaller, and shorter.

Body about .25 of an inch high and broad; length of inner tentacles .6 to .7 of an inch.

Color brownish. Smaller specimens bluish brown; column white.

Port Lloyd, Bonin Islands, attached in great numbers to coral branches, in one fathom, October, 1854. Dr. Wm. Stimpson.

The tentacles are represented as too nearly equal, in the figure of this species.

PARANTHEA ARMATA Verrill, sp. nov.

Body very small in proportion to the size of the tentacles which frequently cover and entirely conceal it. Tentacles in about two or three confused rows; inner ones longer and larger, about twenty-four in number, prominent, twelve of them nearest the mouth and erect.

Color of body light cabbage-red; inner tentacles streaked with white at their inner bases.

Ly-ce-moon Passage, Hong Kong, attached to the branches of a large dead *Gorgonia*, in twenty-five fathoms, rocks, March, 1855. Dr. Wm. Stimpson.

COMACTIS FLAGELLIFERA E. and H., op. cit. p. 236.

Actinia flagellifera Drayton, in Dana, Zoöphytes, Expl. Exp. p. 126, Plate 1, fig. 1, 1846.

Funchal Bay, Madeira, on rocks in the fourth division of the littoral zone; often on small boulders exposed to the surf, July, 1853. Dr. Wm. Stimpson.

The alcoholic specimens have the very numerous, subequal, crowded tentacles contracted to a stout, tapering form, about .25 of an inch long and with a very distinct

opening at the tips. The column is very short, with a fold below the margin, and separated from it by a "fosse." On the outer edge of the fold the tubercles form a simple row. They are prominent, round, smooth, and nearly equal.

SUBFAMILY, PHELLINÆ Verrill.

Capneæ Duch. and Mich., Corall. des Antilles (non *Capneadæ* Gosse).

Column elongated, the basal portion, and often the greater part of the length, covered with a persistent epidermal layer, coated with mud or sand, etc.; the upper portion naked, sometimes papillose. "Acontia" few and thrown out sparingly and reluctantly; unobserved and perhaps wanting in many species.

The presence of a persistent and often tough epidermal deposit in this group would seem to be incompatible with the presence of loop-holes (*cinclidæ*) and *acontia*, and such organs have, indeed, been observed only in very few species. But Gosse mentions, as throwing out *acontia* sparingly from the base, the typical species of *Phellia*, and another species (*P. Brodrickii* Gosse) is said to emit them reluctantly from the mouth.

AMMONACTIS Verrill, these Proceedings, IV, p. 150, 1865.

AMMONACTIS RUBRICOLLUM Verrill, loc. cit. p. 151.

Edwardsia rubricollum Stimpson, Proc. Philadelphia Acad. Natural Science, Vol. 7, 1855, p. 376.

Plate 3, figure 5, 5a.

Column much elongated in expansion, covered to near the top with a loose, dirt-colored epidermis; above this naked, and minutely wrinkled. Just below the tentacles the margin is surrounded by a row of prominent, bead-like, perforated tubercles, which during contraction eject water. Tentacles stout, elongated, tapering to a point, about forty in number, arranged close to the margin, in

two rows, with twice as many in the outer as in the inner. The inner ones alternating with every second interval between the outer ones. Mouth broad, oval; borders wrinkled.

Column, upon the naked space below the tentacles, bright salmon-red; tentacles transparent fawn-color; disk pale yellow with a dark ring around the base of each tentacle; inside of mouth deep red. Height about four inches in expansion.

Harbor of Hong Kong, attached to stones or shells, beneath coarse sand, through which they rise to expand the tentacles at the surface. Dr. Wm. Stimpson.

PHELLIA Gosse, *Annals and Mag. Nat. Hist.*, Ser. 3, Vol. II, p. 193.

Capnea Duch. and Mich., *Supl. Corall. des Antilles*, p. 127, 1865, (*non* Forbes).

Column partly covered with a persistent epidermal layer, upper part naked, smooth; sometimes with a few loop-holes. Margin simple, neither tuberculated nor papillose. Tentacles marginal, in more than one row, not numerous, subequal, or the inner ones considerably longest, outer ones sometimes with constrictions. Disk simple, concave.

PHELLIA *INEQUALIS* Verrill, sp. nov.

Plate 3, figures 4, 4a, 4b.

Column much elongated, somewhat worm-like, almost entirely covered with a brownish, persistent epidermis, lightest below, which shows irregular longitudinal lines; a narrow naked space just below the tentacles. Tentacles about forty, slender, the twenty internal ones are considerably longer than the twenty composing the outer row; the latter are very short, and have three constrictions.

In life the internal tentacles are brownish, tipped with vermilion; external ones pale, with three white rings at the constrictions.

Length in expansion about 2.25 inches ; diameter .62.

Port Lloyd, Bonin Islands, attached to pebbles beneath the surface, in the lower part of the littoral zone. Dr. Wm. Stimpson.

When contracted in alcohol the specimens are one inch to 1.25 long, and .40 to .60 in the greatest diameter. The column is the largest in the middle, diminishing below to the base which is a little expanded. At about the upper third the column suddenly becomes smaller, with strong longitudinal sulcations, between which the surface rises up into papilla-like prominences ; the rest of the column is faintly sulcated longitudinally and strongly wrinkled transversely. The whole column, except a very narrow zone close to the upper margin, is covered by a closely adherent, firm, yellowish brown epidermis. No acontia or loop-holes observable.

This species differs considerably from the typical *Phellia* described by Gosse, and might, with some reason be generically separated. Should this be thought desirable I would suggest the name *Paraphellia*. The principal structural peculiarities are the extremely short, knotted, outer tentacles ; the very narrow, submarginal, naked zone ; the firm, inseparable epidermis, and the papillose appearance of the upper part in contraction. The last two characters are also found in *P. gausapata* Gosse.

Phellia clavata Verrill, these Proc. IV, p. 150, 1865.

Edwardia clavata Stimpson, loc. cit. p. 376, 1855, (non *Capnea clavata* Duch. et Mich., 1860, = *Phellia Americana* V.).

Vol. VI., plate 1, figures 3, 3a, 3b.

Base small. Column elongated, thick, enlarging upward, covered by a thick, inseparable epidermis, except for a narrow naked space below the tentacles, becoming sandy towards the base. Tentacles about forty in two circles, about twenty in each ; inner ones stouter and longer, usually erect ; outer ones horizontal ; mouth broad, oval, margin with strong folds.

Color of epidermis dark greenish, brownish below; narrow naked space below the tentacles purplish brown; outer tentacles purplish brown, with transverse blotches of white; inner ones pale yellow, irregularly annulated with dark purplish brown. Disk and bases of inner tentacles dark purplish brown, with a few streaks of opaque white. Height about 2.25 inches; greatest diameter .85.

Kikaiasima (near Ousima), Japan, in a sheltered harbor, attached to the under surface of stones in slimy, weedy places, January, 1855. Dr. Wm. Stimpson.

The specimen, contracted in alcohol, is largest in the middle, suddenly contracting above, diminishing gradually below. Above the constriction the surface is strongly sulcated longitudinally, with soft rounded papillæ between the grooves. The naked part below the tentacles is inflated and wrinkled. On one side, a little below the margin, there is a rounded opening with distinct, thickened margins, about .04 in diameter. Margin of disk forms a well defined, smooth rim. Lower part of column with a thin, close epidermis.

The name, *clavata*, having been first used by Dr. Wm. Stimpson for this species of *Phellia*, I have called the species, described by Duchassaing and Michelotti, *Phellia Americana* (*Paractis clavata* Duch. and Mich., Corall. des Antilles. p. 40, 1860, Pl. 6, figs. 7, 8).

Phellia collaris Verrill, these Proc. IV, p. 151., 1865.

Edwardsia collaris Stimpson, loc. cit., p. 376, 1855.

Vol. VI, plate 1, figures 2, 2 a.

Base broad. Column much elongated, tapering toward the summit, below the tentacles with a broad naked band, other parts covered with dirty brownish epidermis, to which fine particles of mud adhere closely. Tentacles about forty, small, slender, crowded.

Color of naked part of column whitish, marked with eight fusiform streaks of brown. Tentacles brown. Height of column in expansion 1.40 inches; diameter .62.

Near Hong Kong, on a stone in the third region of the littoral zone, April, 1854. Dr. Wm. Stimpson.

The specimen, contracted in alcohol, is smallest in the middle, where the surface is finely wrinkled transversely and covered with small roundish papillæ; epidermis closely adherent. The base and the region just above it are dilated and have a thin, translucent texture, gradually merging into the portion covered with the epidermis. The naked region below the tentacles is also dilated, and the integument is thin, longitudinally lined, and covered with very small, granule-like papillæ, which become closer below and merge into the epidermal region. No lateral openings apparent. Length one inch; diameter .5.

PHELLIA sp.

In alcohol about one inch long, .35 in diameter; the upper end involved and showing strong radiating folds, which extend downward beyond the middle of the body. Epidermis thin, closely adherent.

Bonin Islands. Dr. Wm. Stimpson.

PHELLIA sp.

A large species. When contracted in alcohol 1.25 inches long; .5 in diameter. Integument firm and thick, longitudinally and transversely wrinkled, covered with a coarse, dark, brownish, inseparable epidermis, except just below the tentacles, where there is a narrow, naked space.

Ousima. Dr. Wm. Stimpson.

PHELLIA ARCTICA Verrill, sp. nov.

Column enlarged at base, in an alcoholic specimen, diminishing upward to near the margin; covered, except within about .1 of an inch of the margin, with a thick, roughened epidermis, which easily peels off, leaving a firm, minutely roughened and transversely wrinkled wall; naked space below the tentacles smooth. Tentacles slender, elongated, subequal, arranged in two close

rows, about twenty-four in each row. Disk narrow; mouth everted. Toward the base of the column there are, in the only specimen seen, smooth, yellow, spherical, ova-like bodies, embedded in circular cavities formed in the epidermis and true wall, which are partially open outwardly so as to expose a small portion of the enclosed body, which can be easily removed by enlarging the opening of the cavities. These are arranged pretty regularly in quincunx in four transverse rows all around the lower third of the column, and rather distant. They are about .5 of an inch in diameter, and their nature is quite uncertain. Possibly they are the eggs of some parasite. Height, in alcohol, .7 of an inch; diameter of base, .45; of disk, .20.

Arctic Ocean, north of Behring's Straits, in thirty fathoms. Capt. John Rodgers.

The above description has been made from a specimen beautifully preserved in alcohol, with the disk and tentacles expanded. The column is doubtless much contracted, especially in length.

In addition to those enumerated above, the following species belong to this genus.

Phellia murocincta Gosse, Actinologia Britanica, p. 135, Pl. vii, fig. 2; xii, fig. 8.

Phellia gausapata Gosse, op. cit., p. 140, Pl. vii, fig. 1.

Phellia picta Gosse, op. cit. p. 143, Pl. xii, fig. 1.

Phellia Brodrickii Gosse, op. cit. p. 349, Pl. viii, fig. 2.

Phellia Vernonia Verrill = *Capnea Vernonia* Duch. and Mich., Supl. Corall. des Antilles, Mem. Reale Accad. delle Sci., Turin, xxiii, p. 127, Pl. v, fig. 9, 1866, (1864?).

Phellia Americana Verrill = *Capnea clavata* D. & M., l. cit.

Phellia cricoides Verrill = *Capnea cricoides* D. & M., l. c., p. 128; and Corall. des Antilles, 1860, p. 40, Pl. vi, fig. 4.

Phellia Coreopsis Verrill = *Capnea Coreopsis* D. & M., Supl. Corall. des Ant., p. 128, Pl. v, fig. 13, 1866 (1864?).

In addition to these there are several undescribed species found at Panama and vicinity.

The genus *Capneopsis* Duch. and Mich., Supl. p. 128, is evidently closely allied. The only species, *C. Solidago*, lives buried in sand to the tentacles.

EXPLANATION OF PLATES.

PLATE 1.*

Figure 1, *BALANOPHYLLIA CAPENSIS* Verrill.

Figure 2, *DENDROPHYLLIA GRACILIS* Verrill.

Figure 3, *DIASERIS PULCHELLA* Verrill.

Figure 4, *PARANTHEA MINUTA* Verrill, natural size, Bonin Islands. The tentacles are represented as too nearly equal.

Figure 5, *SAGARTIA RADIATA* Verrill, natural size; 5a, disk and tentacles; 5b, a tentacle enlarged. Kagosima Bay, Japan.

Figure 6, *URTICINA COCCINEA* Verrill, showing part of disk and tentacles, natural size. Kagosima Bay, Japan.

Figure 7, *CERIANTHUS STIMPSONII* Verrill, natural size; 7a, inner tentacles. Bonin Islands.

Figure 8, *CORYNACTIS ANNULATA* Verrill, natural size, in expansion; 8a, disk and tentacles enlarged. Cape of Good Hope.

PLATE 3.

Figure 1, *HALOCAMPA STIMPSONII* Verrill, enlarged. Cape of Good Hope.

Figure 2, *HALOCAMPA BREVICORNIS* Verrill, side view, much enlarged; 2a, natural size, with tentacles withdrawn; 2b, a tentacle magnified. Hong Kong, China.

Figure 3, *HALOCAMPA CAPENSIS* Verrill, side view, much enlarged. Cape of Good Hope.

Figure 4, *PHELLIA INEQUALIS* Verrill, side view, natural size; 4a, an inner tentacle; 4b, an outer tentacle. Bonin Islands.

Figure 5, *AMMONACTIS RUBRICOLLUM* Verrill, side view, natural size; 5a, a tentacle and submarginal tubercle seen in profile. Hong Kong, China.

* Since printing the former explanation of this plate (p. 50) it has been found necessary to change some of the generic names.

[To be concluded in Vol. VI.]

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PLATES.

Plate 1, accompanying Prof. Verrill's Paper, explanation on page 50, and repeated with some changes on page 330.

Plate 2, accompanying Prof Verrill's Paper, explanation on page 50.

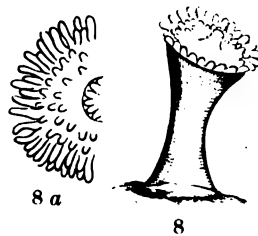
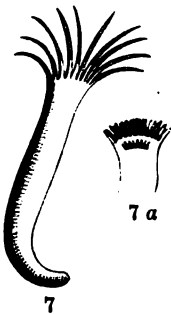
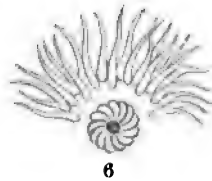
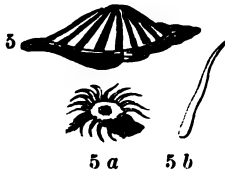
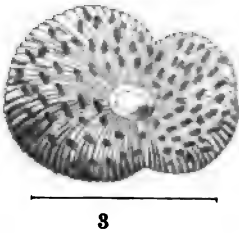
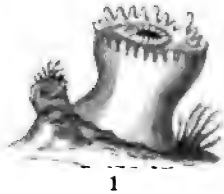
Plate 3, accompanying Prof. Verrill's Paper, explanation on page 330.

Plate 4, (marked and referred to as Plate 15) accompanying Mr. Hyatt's Paper, explanation on p. 232.

ERRATA.

Page 12, line 19, for *grœlandicus* read *Grœlandicus*.

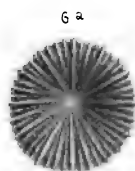
Page 115. In describing the fruit of *COCCULUS FERRANDIANUS*, its dimensions are given as "about 2' [inches] in diameter." It should read about 2'' [lines] in diameter.

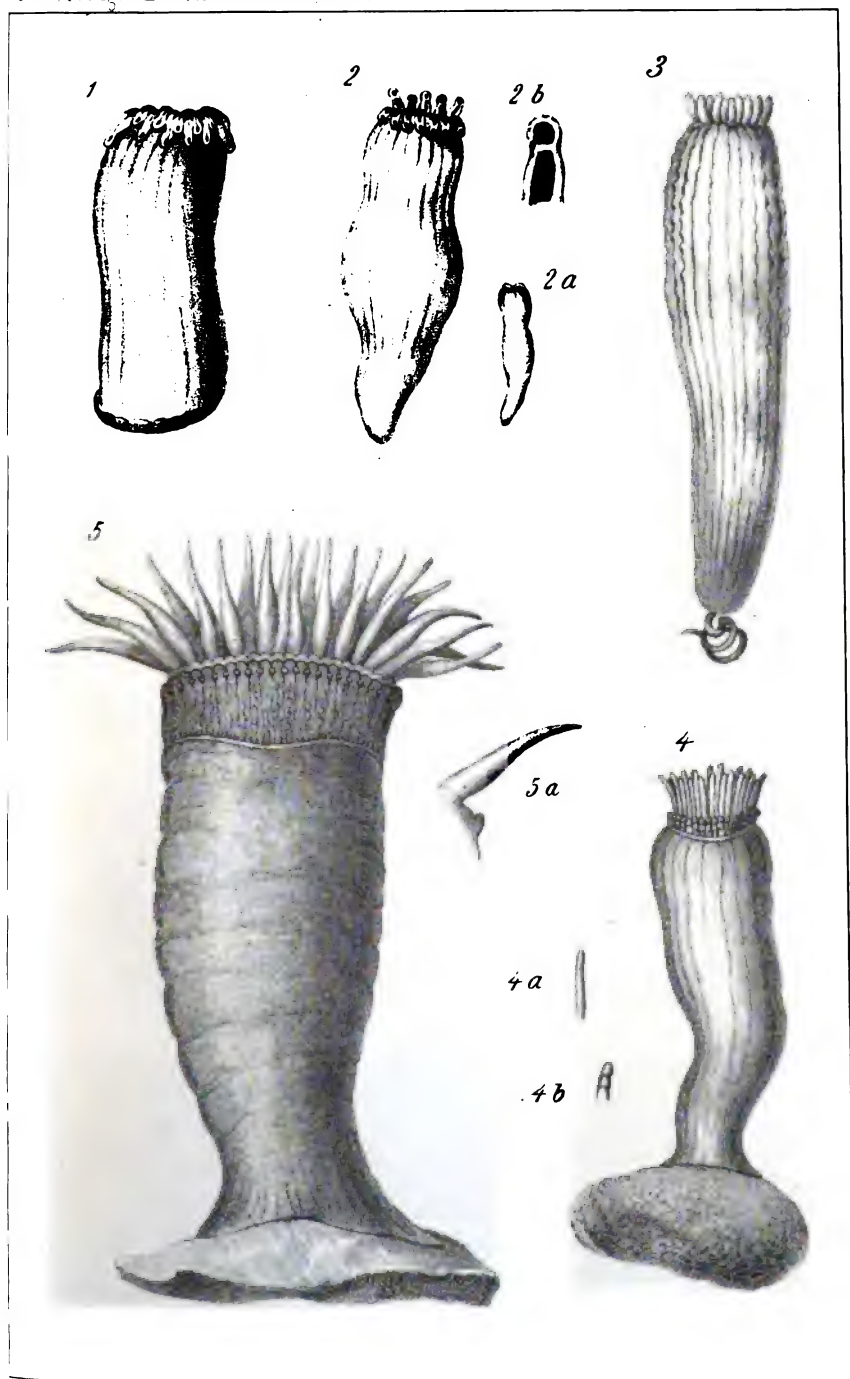


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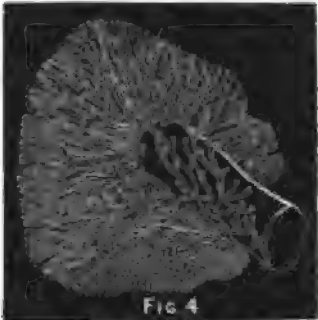
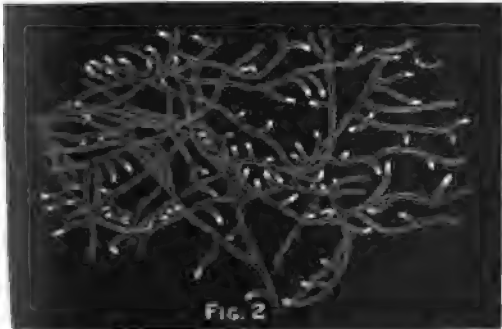
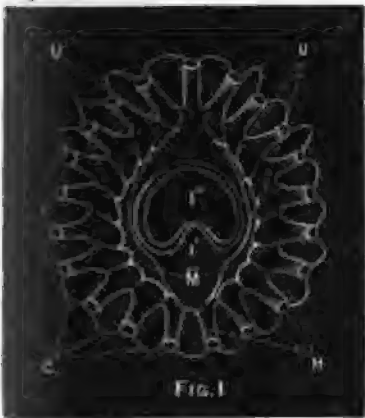
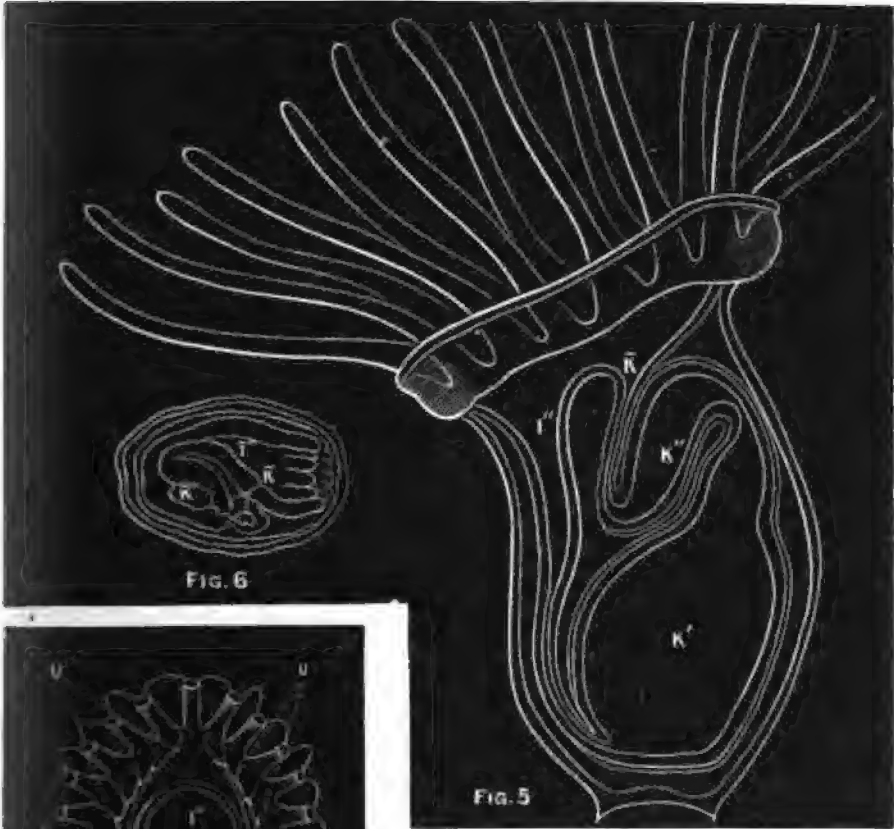
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INTRODUCTION.

In this part of the "Naturalists' Directory" the addresses of the various persons are given under a systematical arrangement. A geographical grouping of the names and an alphabetical index will follow.

The number preceding each name is given to facilitate indexing.

This part will be issued with the "Proceedings," several pages at a time, as fast as it can be prepared.

The Editor returns his thanks to the numerous friends who have aided him, since the publication of the first part, by sending new names and corrections, and earnestly hopes that his attention may be called to any mistakes or omissions noticed in this second part, at as early a day as possible.

Information respecting Naturalists residing in the Southern States and Mexico is especially requested.

Those persons who have not answered the circulars forwarded to them are requested to do so, even if their addresses are correctly given, as it is only from the personal statement of each that perfect confidence can be had in the printed list. In regard to this subject, the Editor would state that answers have been received to the greater part of the circulars issued. The addresses which are left doubtful from the non receipt of answers, will be designated at the close of this part.

Notices of the decease or change of address, of persons whose names appear in the Directory are particularly requested.

Owing to the large number of names which have been received since the first twenty pages of this part of the Directory were issued, and the various corrections which have been made, it has been thought best to reprint them, especially as it was desirable to slightly change the arrangement of the names. Subscribers to the work will therefore please substitute this edition for the former.

F. W. PUTNAM,

Editor.

Essex Institute, Salem, Mass.,
May 1, 1866.

NATURALISTS' DIRECTORY.

GEOLOGY.

1. Prof. LOUIS AGASSIZ (Professor of Zoölogy and Geology, Harvard University; Director and Curator, Museum of Comparative Zoölogy), Cambridge, Mass. *General.*
2. Prof. WM. E. A. ATKIN (Professor of Chemistry and Pharmacy, University of Maryland; Swan Lecturer on applied Chemistry, Maryland Institute), 25 Hamilton street, Baltimore, Md. *North American.*
3. HENRY D'ALIGNY (Mining Engineer; Resident Agent, St. Mary's Canal Mineral Land Co.), Houghton, L. S., Mich. *North American.*
4. Prof. E. B. ANDREWS (Professor of Chemistry, Mineralogy and Geology, Marietta College), Marietta, Ohio. *North American.*
5. AUSTIN BACON, Natick, Mass. *Local.*
6. Prof. L. W. BAILEY (Professor of Chemistry and Natural History, University of New Brunswick), Fredericton, New Brunswick. *Local.*
7. D. M. BALCH (Chemist), Salem, Mass. *Local.*
8. Rev. M. W. BEAUCHAMP, King's Ferry, Cayuga, N. Y. *Local.*
9. GEORGE BECK, Lockport, N. Y. *Local.*
10. Prof. ROBERT BELL (Professor of Natural History, Chemistry and Geology, Queen's University; Assistant, Geological Survey of Canada; Secretary, Botanical Society of Canada), Kingston, Canada West. *North American.*
11. Prof. JAMES G. BLAIR, Athens, Ohio. *North American.*
12. Prof. W. P. BLAKE (Director and Professor of Mineralogy, Geology and Mining, Mining and Agricultural College), Post Office box 2077, San Francisco, Cal. *North American.*
13. FRANK H. BRADLEY (Curator of Geology, Yale College), New Haven, Ct. *North American.*
14. G. C. BROADHEAD, Pleasant Hill, Cass Co., Mo. *North American.*
15. Prof. EZRA L. CARR (Professor of Chemistry and Natural History, Wisconsin State University), Beloit, Wis. *Local.*
16. SAMUEL R. CARTER, Paris Hill, Oxford Co., Me. *Local.*

17. Prof. CHARLES F. CHANDLER (Professor of Chemistry, School of Mines, Columbia College), East Forty-ninth street, New, York, N. Y. *North American*.
18. Prof. EDWARD J. CHAPMAN (Professor of Mineralogy and Geology, University College), Toronto, Canada West. *North American*.
19. T. APOLEON CHENEY (Librarian, Georgic Library), Havana, N. Y. *Local*.
20. CHANDLER CHILDS, Des Moines, Iowa. *Local*.
21. Prof. GEORGE H. COOK (State Geologist of New Jersey; Professor of Chemistry and Natural History, Rutgers College), New Brunswick, N. J. *North American*.
22. Rev. SYLVESTER COWLES, West Randolph Cattaraugus Co., N. Y. *Local*.
23. E. T. COX, New Harmony, Ind. *Local*.
24. Dr. E. S. CROSIER, New Albany, Ind. *Local*.
25. HIRAM A. CUTTING, Lunenburg, Essex Co., Vt. *Local*.
26. Prof. JAMES D. DANA (Professor of Geology and Mineralogy, Yale College), New Haven, Ct. *General*.
27. Prof. J. W. DAWSON (Principal, McGill University), Montreal, Canada. *British North America*.
28. ANDREW DICKSON, Kingston, Canada West. *North American*.
29. H. DODGE, Skaneateles, N. Y. *Local*.
30. Rev. E. B. EDDY, Waltham, Mass. *Local*.
31. Dr. M. N. ELROD, Jeffersonville, Ind. *Local*.
32. L. ENGELBROCHT, Portsmouth, Ohio. *Local*.
33. HENRY ENGELMANN (Mining Engineer), Belleville, Ill. *North American*.
34. Prof. JACOB ENNIS, Philadelphia, Pa. *Local*.
35. C. F. ESCHWEILER (Mining Engineer), No. 110, Springfield street, Boston, Mass. *North American*.
36. Prof. E. W. EVANS, Marietta, Ohio. *North American*.
37. Hon. SAMUEL EWING, Randolph, N. Y. *Local*.
38. Dr. P. J. FARNSWORTH, Lyons, Clinton Co., Iowa. *Local*.
39. J. W. FOSTER (Mining Engineer), Chicago, Ill. *North American*.
40. Hon. GEORGE GEDDES, Fairmount, Onondaga Co., N. Y. *Local*.
41. WM. GOSSIP (Secretary, Nova Scotian Institute of Natural Science), Halifax, Nova Scotia. *Local*.
42. A. D. HAGER (State Geologist of Vermont; Curator of Vermont State Cabinet), Proctorsville, Vt. *North American*.
43. Prof. JAMES HALL (State Geologist of New York, Iowa and Wisconsin), Albany, N. Y. *General*.
44. Rev. SAMUEL R. HALL, Brownington, Vt. *Local*.

45. ISAAC N. HARMON, Chicago, Ill. *Local*.
46. LOUIS HARPER (Mining Engineer), No. 1, Rector street, New York, N. Y. *North American*.
47. F. HAWN, Leavenworth City, Kansas. *North American*.
48. Dr. F. V. HAYDEN, Smithsonian Institution, Washington, D. C. *North American*.
49. E. W. HILGARD (State Geologist of Mississippi), Oxford, Miss. *North American*.
50. S. W. HILL, Houghton, Mich. *Local*.
51. C. H. HITCHCOCK, No. 37, Park Row, New York, N. Y. *North American*.
52. JAMES T. HODGE, Newburg, N. Y. *North American*.
53. Prof. FRANCIS S. HOLMES, College of Charleston, Charleston, S. C. *Local*.
54. Rev. Dr. HONEYMAN, Antigonish, Nova Scotia. *Local*.
55. Prof. EDMUND O. HOVEY (Professor of Chemistry and Geology, Wabash College), Crawfordsville, Ind. *Local*.
56. Prof. HENRY HOW (Professor of Chemistry and Natural History, University of King's College), Windsor, Nova Scotia. *North American*.
57. ROBERT HOWELL, Nichols, Tioga Co., N. Y. *Local*.
58. Prof. O. P. HUBBARD (Professor of Chemistry, Mineralogy and Geology, Dartmouth College), Hanover, N. H. *North American*.
59. Dr. C. T. JACKSON (Vice President, Boston Society of Natural History), Boston, Mass. *North American*.
60. JOHN JENKINS, Monroe, Orange Co., N. Y. *Local*.
61. Prof. JOHN JOHNSTON (Professor of Natural Sciences, Wesleyan University), Middletown, Ct. *North American*.
62. JAMES P. KIMBALL (Mining Engineer), No. 33, Wall street, and 40 St. Mark's Place, New York, N. Y. *North American*.
63. CLARENCE KING (Assistant, California Geological Survey), Irvington, N. Y. and San Francisco, Cal. *North American*.
64. JOHN H. KLIPPART, Columbus, Ohio. *Local*.
65. I. A. LAPHAM, Milwaukee, Wis. *Local*.
66. Dr. GEORGE A. LATHROP, East Saginaw, Mich. *Local*.
67. ISAAC LEA (Vice President, American Philosophical Society), No. 1622, Locust street, Philadelphia, Pa. *North American*.
68. JOSEPH LESLEY, Office Pennsylvania R. R., Philadelphia, Pa. *North American*.
69. J. P. LESLEY (Professor of Mining, University of Pennsylvania; Fourth Secretary and Librarian, American Philosophical Society), No. 1016, Clinton street, Philadelphia, Pa. *North American*.

70. Prof. LEO LESQUERREUX, Columbus, Ohio. *North American.*
71. ELIAS LEWIS (Chairman of the Committee on Natural History, Long Island Historical Society), No. 18, Court street, Brooklyn, N. Y. *Local.*
72. Rev. SAMUEL LOCKWOOD, Keyport, N. J. *Cretaceous. Local.*
73. Sir WILLIAM E. LOGAN (Director, Geological Survey of Canada), Montreal, Canada. *General.*
74. Rev. J. E. LONG, Hublersburg, Centre Co., Pa. *Local.*
75. BENJ. SMITH LYMAN (Mining Engineer), No. 35, South Fifth street, Philadelphia, Pa. *North American.*
76. SYDNEY S. LYON, Jeffersonville, Ind. *North American.*
77. Prof. OLIVER MARCY (Professor of Natural History, North-western University), Evanston, Ill. *North American.*
78. Dr. R. P. MASON, Milford, Ohio. *Local.*
79. G. F. MATTHEW (Curator, Natural History Society of St. John), St. John, New Brunswick. *Local.*
80. Prof. J. H. MCCHESENEY, Jacksonville, Ill. *North American.*
81. R. MCFARLANE, Fort Anderson, British America. *Local.*
82. F. B. MEEK, Smithsonian Institution, Washington, D. C. *North American.*
83. Hon. ANSON S. MILLER, Rockford, Ill. *Local.*
84. Rev. JAMES E. MILLS, Amherst, Nova Scotia. *North American.*
85. Prof. JOSEPH MOORE (Professor of Natural History, Earlham College), Richmond, Ind. *Local.*
86. BENJAMIN F. MUDGE (Professor of Natural History, Kansas State Agricultural College), Manhattan, Kansas. *North American.*
87. ALEXANDER MURRAY, St. Johns, New Foundland. *North American.*
88. Prof. HENRY B. NASON, Beloit, Wis. *North American.*
89. J. V. C. NELLIS, Auburn, N. Y. *Local.*
90. Dr. J. S. NEWBERRY, Cleveland, Ohio. *North American.*
91. JOHN A. NICHOLS, Poultney, Vt. *Local.*
92. W. H. NILES (Lecturer Massachusetts State Teacher's Institute), New Haven, Ct. *North American.*
93. Prof. J. G. NORWOOD (Professor of Natural Science and Natural Philosophy, Missouri State University), Columbia, Boone County, Mo. *North American.*
94. J. KELLY O'NEALE, Lebanon, Ohio. *Local.*
95. Prof. RICHARD OWEN (Professor of Natural Sciences, Indiana State University), Bloomington, Ind., from Sept. 1 to July 1; rest of the year, New Harmony, Ind. *North American.*
96. Prof. THEODORE S. PARVIN (Professor of Natural History, Iowa State University), Iowa City, Iowa. *North American.*

97. Prof. E. J. PICKETT, Rochester, N. Y. *North American.*
98. Dr. WILLIAM PRESCOTT, Concord, N. H. *Local.*
99. RAPHAEL PUMPELLY, Owego, N. Y. *Arizona, China, Japan.*
100. Hon. H. S. RANDALL, Cortland Village, N. Y. *Local.*
101. Dr. SAMUEL REID, New Albany, Ind. *Local.*
102. E. J. RICE, Muncie, Ind. *Local.*
103. JAMES RICHARDS, Litchfield, Ct. *Local.*
104. R. A. RIDEOUT, Garland, Me. *Local.*
105. Prof. WM. B. ROGERS (President, Massachusetts Institute of Technology; Corresponding Secretary, American Academy of Arts and Sciences), Boston, Mass. *General.*
106. JOSEPH M. ROWELL, Lynn, Mass. *Local.*
107. Prof. JAMES M. SAFFORD, (State Geologist of Tennessee), Post Office box 36, Nashville, Tenn. *North American.*
108. PETER W. SHEAFER, Pottsville, Schuylkill Co., Pa. *Coal.*
109. Dr. B. F. SHUMARD, St. Louis, Mo. *North American.*
110. Prof. BENJAMIN SILLIMAN (Professor of Chemistry, Yale College), New Haven, Ct. *North American.*
111. Dr. R. P. STEVENS, New York, N. Y. *North American.*
112. O. H. ST. JOHN, Waterloo, Iowa. *Local.*
113. CHARLES STODDER, No. 75, Kilby street, Boston, Mass. *Local.*
114. R. H. STRETCH, Virginia City, Nevada. *North American.*
115. JOSEPH SULLIVANT, Columbus, Ohio. *Local.*
116. Prof. G. C. SWALLOW (State Geologist of Kansas), Columbia, Boone Co., Mo. *North American.*
117. Prof. SANBORN TENNEY (Professor of Natural History, Vassar Female College, Poughkeepsie, N. Y. *North American.*
118. W. H. B. THOMAS, Mount Holly, N. J. *North American.*
119. C. B. TREGO, No. 612, North Thirteenth street, Philadelphia, Pa. *North American.*
120. Dr. JOHN B. TRASK, San Francisco, Cal. *Local.*
121. PHILIP T. TYSON (State Geologist of Maryland), Baltimore, Md. *North American.*
122. Prof. A. E. VERRILL, (Mining Engineer; Professor of Zoölogy, Yale College), New Haven, Ct. *North American.*
123. T. C. WALBRIDGE, Belleville, Upper Canada. *Local.*
124. R. P. WHITFIELD, Albany, N. Y. *North American.*
125. Dr. CHARLES A. WHITE, Iowa City, Iowa. *North American.*
126. Prof. J. D. WHITNEY (State Geologist of California), San Francisco, Cal., and Northampton, Mass. *North American.*
127. Col. CHARLES WHITTLESEY, Cleveland, Ohio. *North American.*

128. CHARLES P. WILLIAMS, No. 138, Walnut street, Philadelphia, Pa. *North American*.
129. Prof. ALEXANDER WINCHELL (Professor of Natural History, Michigan State University), Ann Arbor, Mich. *North American*.
130. A. H. WORTHEN (State Geologist of Illinois) Springfield, Ill. *North American*.

MINERALOGY.

131. HENRY D'ALIGNY (Mining Engineer; Resident Agent, St. Mary's Canal Mineral Land Co.), Houghton, L. S., Mich.
132. OSCAR D. ALLEN, Camden, N. J.
133. S. C. H. BAILLY, No. 5, Beekman street, New York, N. Y.
134. EDWARD E. BARDEN, Rockport, Mass.
135. VINCENT BARNARD, Kennett Square, Chester Co., Pa. *A Collector*.
136. WM. BARNES (Mining Engineer), Post Office box 274, Halifax, Nova Scotia.
137. Rev. E. R. BEADLE, Philadelphia, Pa.
138. Prof. ROBERT BELL (Assistant, Geological Survey of Canada; Secretary, Botanical Society of Canada; Professor of Natural History, Chemistry and Geology, Queen's University), Kingston, Canada West.
139. Prof. W. P. BLAKE (Director, and Professor of Mineralogy, Geology and Mining, College of California), Post Office box 2077, San Francisco, Cal.
140. T. T. BOUVÉ (Curator of Palæontology and Mineralogy, Boston Society of Natural History), Boston, Mass.
141. Prof. P. D. BRADFORD (Professor of Physiology and Pathology, Castleton Medical College), Northfield, Vt.
142. C. G. BREWSTER, No. 16, Tremont street, Boston. *A Dealer*.
143. W. T. BRIGHAM, Boston Society of Natural History, Boston, Mass.
144. C. M. BROWNE, No. 84, John street, New York, N. Y.
145. CHR. C. BROOKS, No. 53, St. Paul street, Baltimore, Md.
146. Prof. GEORGE J. BRUSH (Professor of Mineralogy and Metallurgy, Yale College), New Haven, Ct.
147. STUART M. BUCK, Boston, Mass.
148. A. R. BURTON, Bethlehem, N. H.
149. Prof. JAMES BUSHEE (Curator of Mineralogy, Worcester Society of Natural History), Worcester, Mass.
150. Dr. JOHN CARDEZA, Claymont, Del.
151. SAMUEL R. CARTER, Paris Hill, Oxford Co., Me.

152. Prof. CHARLES F. CHANDLER (Professor of Chemistry, School of Mines, Columbia College), East Forty-ninth street, New York, N. Y.
153. Prof. EDWARD J. CHAPMAN (Professor of Mineralogy and Geology, University College), Toronto, Canada West.
154. ISAAC B. CHOATE, Portland, Me.
155. Rev. A. P. CHUTE, Sharon, Mass.
156. Prof. W. S. CLARK (Professor of Chemistry, Amherst College), Amherst, Mass.
157. JOSEPH A. CLAY, No. 271, South Fifth street, Philadelphia, Pa.
158. Dr. M. H. COATES, Philadelphia, Pa.
159. F. G. COFFIN, Machias, Me.
160. Prof. J. P. COOKE (Professor of Chemistry, Harvard College), Cambridge, Mass.
161. Prof. JAMES D. DANA (Professor of Geology and Mineralogy, Yale College), New Haven, Ct.
162. JOSEPH DELAFIELD, No. 59, Wall street, New York, N. Y.
163. A. DIETY, St. Thomas, West Indies.
164. Prof. ALFRED DU BOIS, Denver, Colorado.
165. E. M. DUNBAR, Springfield, Mass.
166. Rev. E. B. EDDY, Waltham, Mass.
167. Prof. THOMAS EGLESTON (Professor of Mineralogy and Metallurgy, Columbia College), No. 10, Fifth avenue, New York, N. Y.
168. JAMES EIGHTS, Albany, N. Y. *A Dealer.*
169. HENRY ENGELMANN (Mining Engineer), Belleville, Ill.
170. FRANK FAIRBANKS, St. Johnsbury, Vt.
171. CHRISTIAN FEBIYER, Wilmington, Del.
172. M. C. FERNALD, South Levant, Me.
173. Dr. L. FEUCHTWANGER, No. 55, Cedar street, New York, N. Y.
174. GEORGE FISHER, Columbia, Va.
175. Dr. F. A. GENTH, No. 108, Arch street, Philadelphia, Pa.
176. G. K. GILBERT (Assistant, Museum of Prof. Ward), Rochester, N. Y.
177. Dr. C. A. GOESSMAN, Syracuse, N. Y.
178. HENRY A. GREEN, Mt. Morris, N. Y.
179. Prof. TRAILL GREEN (Professor of Chemistry, Lafayette College), Easton, Pa.
180. J. J. H. GREGORY, Marblehead, Mass.
181. Prof. GEORGE HADLEY, Buffalo, N. Y.
182. JAMES D. HAGUE, Portage Lake, Mich.
183. Rev. H. F. HARDING, Machias, Me.
184. Prof. LOUIS HARPER (Mining Engineer), No. 1. Rector street, New York, N. Y.
185. JOSHUA P. HASKELL, Marblehead, Mass.

186. THOMAS C. HASKELL, Swampscott, Mass. [A Dealer.
187. CHR. W. A. HERRMANN, No. 607, Broadway, New York, N. Y.
188. CHARLES H. HIGBEE (Curator of Mineralogy, Essex Institute), Salem, Mass.
189. FRANKLIN B. HOUGH, Albany, N. Y.
190. Prof. HENRY HOW (Professor of Chemistry and Natural History, King's College), Windsor, Nova Scotia.
191. WINNLOW J. HOWARD, No. 345, Grand street, New York, N. Y.
192. Prof. F. S. HOYT (Professor of Natural Science, Delaware University), Delaware, Ohio.
193. Prof. O. P. HUBBARD (Professor of Chemistry, Mineralogy and Geology, Dartmouth College), Hanover, N. H.
194. Prof. T. STERRY HUNT (Chemist, Geological Survey of Canada), Montreal, Canada.
195. W. M. HUNTING, Fairfield, Herkimer Co., N. Y.
196. Dr. C. T. JACKSON (Vice President, Boston Society of Natural History), Boston, Mass.
197. W. W. JEFFERIS (Curator, Chester County Cabinet of Natural Science), Westchester, Pa.
198. JOHN JENKINS, Monroe, Orange Co., N. Y. A Dealer.
199. Prof. S. W. JOHNSON (Professor of Agriculture and Analytical Chemistry, Yale College), New Haven, Ct.
200. Prof. JOHN JOHNSTON (Professor of Natural Science, Wesleyan University), Middletown, Ct.
201. Rev. A. B. KENDIG, Marshalltown, Marshall Co., Iowa.
202. JAMES P. KIMBALL, No. 33, Wall street, and No. 40, St. Mark's Place, New York, N. Y.
203. A. C. KLINE, Philadelphia, Pa. A Dealer.
204. W. J. KNOWLTON, Rockport, Mass.
205. EDWARD KOCH, Toledo, Ohio.
206. JOSIAH LADD, Littleton, N. H.
207. Prof. GEORGE LAWSON (Professor of Chemistry Dalhousie College), Halifax, Nova Scotia.
208. ISAAC LEA (Vice President, American Philosophical Society), No. 1622, Locust street, Philadelphia, Pa.
209. ELIAS LEWIS (Chairman of Committee on Natural History, Long Island Historical Society), No. 16, Court street, Brooklyn, N. Y.
210. Prof. A. LITTON (Professor of Chemistry, St. Louis Medical School and Washington University), St. Louis, Mo.
211. JOHN F. LORD, Ellsworth, Me.
212. Prof. O. C. MARSH, Yale College, New Haven, Ct.
213. Prof. JOHN P. MARSHALL (Professor of Chemistry, Mineralogy and Geology, Tufts College), College Hill, Mass.

214. ISAAC C. MARTINDALE (Director, Byberry Philosophical Society), Byberry, Pa.
215. G. F. MATTHEW (Curator, Natural History Society of St. John), St. John, New Brunswick.
216. HON. ANSON S. MILLER, Rockport, Ill.
217. GIDEON E. MOORE (Curator of Mineralogy, California Academy of Natural Sciences), San. Francisco, Cal.
218. J. V. C. NELLES, Auburn, N. Y.
219. Prof. J. G. NORWOOD (Professor of Natural Sciences and Natural Philosophy, Missouri State University), Columbia, Boone
220. ALBERT ORDWAY, Post Office box 174, Richmond, Va. [Co., Mo.
221. Rev. JAMES ORTON (Teacher of Natural Sciences, Rochester University), Rochester, N. Y.
222. J. D. PARKER, Steuben, Me.
223. LEROY C. PARTRIDGE, Seneca Falls, N. Y.
224. FRANK PEASLEY, Burlington, Iowa.
225. Prof. MAURICE PERKINS (Professor of Chemistry, Union College), Schenectady, N. Y.
226. Prof. ROBERT PETER (Professor of Chemistry and Experimental Philosophy, Kentucky University), Lexington, Ky.
227. STEPHEN D. POOLE, Lynn, Mass.
228. R. A. RIDEOUT, Garland, Me.
229. W. T. ROEPER, Bethlehem, Pa.
230. Prof. OREN ROOT (Professor of Geology and Mineralogy, Hamilton College), Clinton, Oneida Co., N. Y.
231. J. G. SANBORN, Cherryfield, Me.
232. E. SEYMOUR, 52, Beekman street, New York, N. Y. *A Dealer.*
233. Dr. WM. SHARSWOOD, Philadelphia, Pa. *Cerium Minerals.*
234. JAMES M. SHAW, South Waterford, Me.
235. Prof. C. U. SHEPARD (Professor of Natural History, Amherst College), Amherst, Mass.
236. Prof. BENJ. SILLIMAN (Professor of Chemistry, Yale College), New Haven, Ct.
237. JOHN P. SIMONS, Philadelphia, Pa.
238. Dr. J. LAWRENCE SMITH, Louisville, Ky.
239. JOHN MILTON SMITH, No. 18, Wall street, New York, N. Y.
240. Prof. CHAS. S. STONE (Professor of Physics and Chemistry, Cooper Institute), New York, N. Y.
241. D. C. STONE, Marysville, Cal.
242. A. P. STUART, Lawrence Scientific School, Cambridge, Mass.
243. WM. H. STURBRIDGE, No. 93, William street, New York, N. Y.
244. Prof. SANBORN TENNEY (Professor of Natural History, Vassar Female College, Poughkeepsie, N. Y.

- 245. Dr. N. T. TRUE (Editor of *Maine Farmer*), Bethel, Me.
- 246. Dr. CHAS. A. TUFTS, Dover, N. H.
- 247. WM. S. VAUX (Vice President and Curator, Academy of Natural Sciences of Philadelphia), No. 1700, Arch street, Philadelphia, Pa.
- 248. Prof. A. E. VERRILL (Professor of Zoölogy, Yale College), New Haven, Ct.
- 249. C. F. WADSWORTH (Curator of Mineralogy, Buffalo Society of Natural Sciences), Buffalo, N. Y.
- 250. Miss L. E. WALKER (Assistant Curator of Mineralogy, Worcester Society of Natural History), Worcester, Mass.
- 251. Prof. HENRY A. WARD (Professor of Natural Sciences, Rochester University), Rochester, N. Y.
- 252. JOHN W. WARD, Salem, Salem Co., N. J.
- 253. W. E. WELLINGTON, Dubuque, Iowa.
- 254. CHAS. B. WHITING (Assistant Curator of Mineralogy, Worcester Society of Natural History), Worcester, Mass.
- 255. S. F. WHITNEY, Brooklyn, N. Y.
- 256. CHAS. P. WILLIAMS, No. 158, Walnut street, Philadelphia, Pa.
- 257. Dr. S. C. WILLIAMS, Silver Springs, Lancaster Co., Pa. *Local.*
- 258. HENRI N. WOODS, Rockport, Mass.

METALLURGY.

- 259. OSCAR D. ALLEN, Camden, N. J.
- 260. WILLIAM ASHBURNER, San Francisco, Cal.
- 261. Prof. JAMES C. BOOTH, U. S. Mint, Philadelphia, Pa.
- 262. Prof. GEORGE J. BRUSH (Professor of Mineralogy and Metallurgy, Yale College), New Haven, Ct.
- 263. Prof. THOMAS EGGLESTON (Professor of Mineralogy and Metallurgy, Columbia College), No. 10, Fifth avenue, New York, N. Y.
- 264. Dr. F. A. GENTH, No. 108, Walnut street, Philadelphia, Pa.
- 265. Prof. N. P. HILL, Providence, R. I.
- 266. JAMES T. HODGE, Newburg, N. Y.
- 267. HENRY JANIN, San Francisco, Cal.
- 268. LOUIS JANIN, Virginia City, Nevada.
- 269. EDWARD N. KENT, U. S. Assay Office, New York, N. Y.
- 270. GUIDO KUESTEL, San Francisco, Cal.
- 271. GIDEON E. MOORE, Virginia City, Nevada.
- 272. Prof. JOHN TORREY, (U. S. Assayer), New York, N. Y.
- 273. Prof. J. D. WHITNEY (State Geologist of California), San Francisco, Cal., and Northampton, Mass.
- 274. HENRY WURTZ, New York, N. Y.

PALEONTOLOGY.

275. Prof. LOUIS AGASSIZ (Professor of Zoölogy and Geology, Harvard University; Director and Curator Museum of Comp. Zoölogy), Cambridge, Mass. *General*.
276. A. E. R. AGASSIZ (Assistant, Museum of Comp. Zoölogy), Cambridge, Mass. *Radiates and Articulates*. Special, *Echino-derms*.
277. Dr. O. P. BAER, Richmond, Ind. *Local*.
278. HENRY M. BANNISTER, Evanston, Ill. *North American*.
279. JAMES E. BARDEN, Gravesville, Herkimer Co., N. Y. *Local*.
280. Rev. JOSEPH S. BARRIS, Sheenwater, Grand Island, N. Y. *Local*.
281. Prof. WM. H. BARRIS, Davenport, Iowa. *Crinoids*.
282. J. S. BATTERSON, Hartford, Ct. *A Dealer*.
283. Prof. ROBERT BELL (Assistant, Geological Survey of Canada; Secretary, Botanical Society of Canada; Professor of Natural History, Chemistry and Geology, Queen's University), Kingston, Canada West. *North American*.
284. E. BILLINGS (Palæontologist, Geological Survey of Canada), Montreal, Canada. *General*.
285. T. T. BOUVÉ (Curator of Palæontology and Mineralogy, Boston Society of Natural History), Boston, Mass. *General Collection*.
286. FRANK H. BRADLEY, New Haven, Ct. *North American*.
287. C. G. BREWSTER, No. 16, Tremont st., Boston, Mass. *A Dealer*.
288. GEORGE C. BROWN (Curator and Treasurer, Burlington County Lyceum of History and Natural History), Mount Holly, N. J. *Green Sand fossils of New Jersey*.
289. S. T. CARLEY, Cincinnati, Ohio. *Local*.
290. L. B. CASE, Richmond, Ind. *North American*.
291. CHARLES A. CHASE (Librarian and Assistant Curator of Palæontology, Worcester Society of Natural History), Worcester, Mass. *General Collection*.
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579. Miss A. B. EARLE (Assistant Curator of Botany, Worcester Society of Natural History), Worcester, Mass. *Local*.
580. Prof. D. C. EATON (Professor of Botany, Yale College), New Haven, Ct. *General*. Special, *Filices*.
581. ARTHUR M. EDWARDS, No. 49 Jane street, New York, N. Y. *Diatomaceæ*.
582. SAMUEL E. ELMORE, Hartford, Ct. *Local*.
583. GEORGE B. EMERSON, Boston, Mass. *New England*. Special, *Forest Trees*.
584. RUSH. EMERY, Tipton, Iowa. *Local*.
585. FRANCIS E. ENGELHARDT (Professor of Chemistry, St. Francis College), No. 49 West Fifteenth st., New York, N. Y. *Local*.
586. Dr. GEORGE ENGELMANN (President, St. Louis Academy of Science), St. Louis, Mo. *General*.
587. Prof. JACOB ENNIS, Philadelphia, Pa. *Local*.

588. Miss — ERRINGTON, New York, N. Y. *Californian*.
589. Dr. O. EVERETT, Dixon, Lee Co., Ill. *Local*.
590. AUGUSTUS FENDLER, Allenton, St. Louis Co., Mo. *New Mexico and South American*.
591. I. FOOT, Detroit, Mich. *Local*.
592. Dr. E. FOREMAN, Catonsville, Md. *Local*.
593. Rev. JAMES FOWLER, Richibucto, N. B. *Local*.
594. SAMUEL P. FOWLER (Vice President, Essex Institute), Danvers, Mass. *Forest Trees of New England*.
595. J. Q. A. FRITCHEY, St. Louis, Mo. *Local*.
596. CHARLES C. FROST, Brattleborough, Vt. *Local*. *Special*, *Lichens and Fungi*.
597. Dr. C. C. F. GAY (Curator of Botany, Buffalo Society of Natural Science), Buffalo, N. Y. *Local*.
598. GEORGE GIBBS, Washington, D. C. *Oregon and Washington Terr.*
599. Dr. GEORGE L. GOODALE (Curator of Botany, Portland Society of Natural History), Portland, Me. *North American*.
600. Hon. JOHN S. GOULD, Hudson, N. Y. *Local*.
601. Prof. ASA GRAY (Professor of Botany, Harvard University; President, American Academy of Arts and Sciences), Cambridge, Mass. *General*. *Special*, *North American*.
602. Dr. C. GREEN, Homer, N. Y. *Local*.
603. Prof. TRAILL GREEN (Professor of Chemistry, Lafayette College), Easton, Pa. *North American*.
604. THOMAS A. GREENE, New Bedford, Mass. *North American*.
605. ELIHU HALL, Athens, Menard Co., Ill. *North American*.
606. G. P. HARBOUR, Oskaloosa, Iowa. *Rocky Mountains*.
607. FIELDEN HARTLEY, Alton, Ill. *Local*.
608. CLARK C. HASKINS, New Albany, Ind. *Local*.
609. Prof. F. V. HAYDEN (Professor of Geology and Mineralogy, University of Pennsylvania), Philadelphia, Pa. *Upper Missouri*.
610. Dr. G. W. HAZLETINE, Jamestown, N. Y. *Local*.
611. Dr. E. P. HEALY, Medina, N. Y. *Local*.
612. E. W. HERVEY, New Bedford, Mass. *Local*.
613. Prof. E. W. HILGARD (Professor of Chemistry and Mineralogy, University of Mississippi), Oxford, Miss. *North American*.
614. Dr. THEO. C. HILGARD, St. Louis, Mo. *Local*. *Special*, *Fungi and Algae*.
615. Prof. WILLIAM HINCKS (Professor of Natural History, University College; Editor, Canadian Journal of Industry, Science, and Art), Toronto, C. W. *General*. *Special*, *Canadian*.
616. Hon. G. H. HOLLISTER, Litchfield, Ct. *Local*.

617. E. S. HOLMES, Wilson, Niagara Co., N. Y. *Local*.
618. I. F. HOLTON, Medford, Mass. *New Grenada and Local*.
619. JOSHUA HOOPES, Westchester, Pa. *Local*.
620. Dr. ASA HERR, Dubuque, Iowa. *Local*.
621. FRANKLIN B. HOUGH, Albany, N. Y. *North American*.
622. Prof. HENRY HOW (Professor of Chemistry and Natural History, King's College), Windsor, N. S. *Local*.
623. WINSLOW J. HOWARD, No. 345 Grand street, New York, N. Y. *Rocky Mountains*.
624. Dr. ELLIOTT C. HOWE, Troy, N. Y. *Local*.
625. Prof. JAMES HUBBERT (Professor of Natural Sciences, St. Francis College), Richmond, C. E. *Canadian. Special, Fungi*.
626. Dr. A. T. HUDSON, Lyons, Clinton Co., Iowa. *Local*.
627. Dr. G. W. HULSA, Natchez, Miss. *California and Florida*.
628. GEORGE HUNT, Providence, R. I. *Local*.
629. ROBERT INGRAHAM, New Bedford, Mass. *North American Cryptogamia*.
630. HALLIDAY JACKSON, Westchester, Chester Co., Pa. *Local*.
631. Prof. THOMAS P. JAMES (Professor of Botany, Pennsylvania Horticultural Society), No. 400 South Ninth street, Philadelphia, Pa. *North American. Special, Musci*.
632. Dr. H. A. JOHNSON, Chicago, Ill. *Local*.
633. Dr. A. KELLOGG (Librarian, Californian Academy of Natural Science), San Francisco, Cal. *Pacific Coast of America*.
634. C. KESSLER, Reading, Pa. *Local*.
635. JOHN KIRKPATRICK (Secretary, Academy of Natural Sciences of Cleveland; Secretary, Cleveland Horticultural Society, Cleveland, Ohio. *Local*.
636. Dr. JARED P. KIRTLAND, East Rockport, Ohio; Post-office address, Cleveland, Ohio. *Local*.
637. Dr. P. D. KNIESKERN, Shark River, N. J. *Local*.
638. HENRY KREBS, St. Thomas, W. I. *West Indian*.
639. THURE KUMLIEN, Busseyville Post-office, via Albion, Wis. *Wisconsin*.
640. Hon. I. A. LAPHAM (President, Wisconsin Historical Society), Milwaukee, Wis. *North American*.
641. Miss S. L. LAWRENCE (Curator of Botany, Worcester Society of Natural History), Worcester, Mass. *Local*.
642. Prof. GEORGE LAWSON (Professor of Chemistry, Dalhousie College), Halifax, N. S. *North American*.
643. W. H. LEGGETT, No. 224 Tenth street, New York, N. Y. *Local*.

644. Prof. LEO LESQUEREUX, Columbus, Ohio. *General. Special. Musci and Fossil Plants.*
645. FERDINAND LINDHEIMER, New Braunfels, Texas. *Texan.*
646. Dr. GEORGE LITTLE (Mississippi State Geologist), Oxford, Miss. *South Western States.*
647. Rev. SAMUEL LOCKWOOD, Keyport, N. J. *Devonian. Plants of New York.*
648. Rev. J. E. LONG, Hublersburg, Centre Co., Pa. *Local.*
649. H. B. LORD, Ithica, N. Y. *Local.*
650. Dr. STARLING LOVING, Columbus, Ohio. *Local.*
651. J. R. LOWRIE, Olive Post-office, Pa. *Local.*
652. JOHN MACOUN, Belleville, C. W. *Canadian.*
653. HORACE MANN (Curator of Botany, Boston Society of Natural History), Cambridge, Mass. *General.*
654. W. T. MARCH, Spanishtown, Jamaica. *West Indian.*
655. ISAAC C. MARTINDALE (Director, Byberry Philosophical Society), Byberry, Pa. *North American.*
656. Dr. JOSEPH C. MARTINDALE, No. 918 North Twelfth street, Philadelphia, Pa. *Local.*
657. R. MATTHEW, No. 93 Princess street, St. John, N. B. *Local.*
658. Dr. S. B. MEAD, Augusta, Hancock Co., Ill. *Local.*
659. THOMAS MEEHAN (Corresponding Secretary, Pennsylvania Horticultural Society; Editor, Gardener's Monthly), Germantown, Pa. *General. Special. Horticultural.*
660. Dr. EZRA MICHENER, Avondale, Chester Co., Pa. *North American. Special. Fungi.*
661. Hon. ANSON S. MILLER, Rockford, Ill. *Local.*
662. CH. MOHR, Mobile, Alabama. *Local.*
663. Prof. JOSEPH MOORE (Professor of Natural History, Earlham College), Richmond, Ind. *Local.*
664. Prof. W. D. MOORE, Irwin's Station, Pa. *Local.*
665. Dr. SEBASTIAN ALFREDO DE MORALES, Calle de Velarde, No. 5, Matanzas, Cuba. *Cuban.*
666. Miss E. S. MORSE (Assistant Curator of Botany, Worcester Society of Natural History), Worcester, Mass. *Local.*
667. Miss M. E. B. MORTON, Rockford, Winnebago Co., Ill. *Local.*
668. WILLIAM MUIR, Fox Creek Post-office, St. Louis Co., Mo. *Horticultural.*
669. Prof. J. S. NEWBERRY (Professor of Geology, Columbia College), New York, N. Y. *North American. Special. Fossil Plants.*
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671. DR. J. G. ORTON, Binghamton, N. Y. *Local*.
672. DR. HORACE M. PAINE, No. 104 State street, Albany, N. Y. *Local*.
673. REV. JOHN A. PAINE, jr., Newark, N. J. *Local*.
674. CHARLES F. PARKER, Philadelphia, Pa. *Local*.
675. PROF. W. A. PARKER (Professor of —, Iowa College), Grennele, Iowa. *Local*.
676. DR. C. C. PARRY, Davenport, Iowa. *North American*. Special, *Rocky Mountains*.
677. PROF. T. L. PARVIN (Professor of Natural History, Iowa State University), Iowa City, Iowa. *Local*.
678. CHARLES H. PECK, Albany, N. Y. *Local*.
679. E. PECK, Washington, D. C. *North American*.
680. PROF. ROBERT PETER (Professor of Natural Science, Kentucky University), Lexington, Ky. *Local*.
681. THOMAS M. PETERS, Moulton, Ala. *Local*.
682. GEORGE D. PHIPPEN, Salem, Mass. *Local*. Special, *Wild Flowers under cultivation*.
683. DR. ZINA PITCHER, Detroit, Mich. *North American*.
684. ISAAC A. POOL, No. 829 Washington street, Chicago, Ill. *Horticultural*.
685. B. S. PORTER, New Albany, Ind. *Local*.
686. PROF. THOMAS C. PORTER (Professor of Botany and Zoölogy, Lafayette College), Easton, Pa. *North American*. Special, *Pennsylvania*.
687. PROF. A. N. PRENTISS (Professor of Botany and Horticulture, Michigan State Agricultural College), Lansing, Mich. *North American*.
688. MANUEL J. PRESAS, Calle de Velarde, No. 5, Matanzas, Cuba. *Cuban*.
689. WM. H. RAND, Chicago, Ill. *Local*.
690. DR. J. H. RAUCH, Chicago, Ill. *Local*.
691. H. W. RAVENEL, Aiken, S. C. *Local*. Special, *Fungi*.
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693. DR. SAMUEL REID, New Albany, Ind. *Local*.
694. JAMES RICHARDS, Litchfield, Ct. *Local*.
695. DR. J. W. ROBBINS, Uxbridge, Mass. *North American*. Special, *Fresh Water Plants*.
696. JOSEPH T. ROTHROCK, McVeytown, Pa. *General*.
697. PROF. JOHN L. RUSSELL (Professor of Botany, Massachusetts Horticultural Society), Salem, Mass. *North American*. Special, *Cryptogamia*.

698. Prof. ABRAM SAGER (Professor of —, University of Michigan), Ann Arbor, Mich. *Local*.
699. Prof. J. H. SALISBURY (Professor of Physiology, Histology and Cell Pathology, Charity Hospital Medical College), Cleveland, Ohio. *Fungi*.
700. Dr. C. SARTORIUS, Mirader, Mexico. *Local*.
701. Dr. H. P. SARTWELL, Penn Yan, N. Y. *Local*. Special, *Carices*.
702. WILLIAM SAUNDERS, Dundas street, London, Canada West. *North American*.
703. FRANCISCO ADOLFO SAUVALLÉ, Habana, Cuba. *Cuban*.
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706. Dr. ARTHUR SCHOTT, Georgetown, D. C. *Mexico and Central America*.
707. R. ROBINSON SCOTT, Port Kennedy, Pa. *Local*.
708. THOMAS F. SEAL, Unionville, Chester Co., Pa. *Local*.
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710. HENRY SHAW, St. Louis, Mo. *Local*.
711. JAMES M. SHAW, South Waterford, Me. *Local*.
712. Prof. D. S. SHELDON (Professor of Chemistry and Natural Sciences, Griswold College), Davenport, Iowa. *North American*.
713. Dr. A. G. SKINNER, Youngstown, Niagara Co., N. Y. *Local*.
714. AUBREY H. SMITH, No. 1516 Pine street, Philadelphia, Pa. *Local*.
715. CHARLES E. SMITH (President, Reading R. R. Co.), Philadelphia, Pa. *Local*.
716. DANIEL B. SMITH, Germantown, Pa. *Local*.
717. S. I. SMITH, New Haven, Ct. *New England*.
718. WM. R. SMITH (Superintendent United States Botanic Garden), Washington, D. C. *North American*.
719. C. J. SPRAGUE, Boston, Mass. *Fungi*.
720. ISAAC SPRAGUE, Grantville, Mass. *Botanical Artist*.
721. JACOB STAUFFER (Secretary, Linnæan Society of Lancaster), Lancaster, Pa. *Local*.
722. Rev. JAMES STEPHENSON, St. Inigos, St. Mary's Co., Md. *Local*.
723. Dr. GEORGE T. STEVENS, Albany, N. Y. *Local*.
724. Dr. — STIVES, San Francisco, Cal. *Californian*. Special, *Algæ*.
725. SAMUEL STURTON, Quebec, Canada. *Canadian*.
726. WM. S. SULLIVANT, Columbus, Ohio. *General*. Special, *Musci*.
727. Rev. J. A. SWAN, Kennebunk, Me. *Local*.
728. EDWARD TATNALL, Wilmington, Del. *Local*.

729. Prof. SANBORN TENNEY (Professor of Natural Sciences, Vassar Female College), Poughkeepsie, N. Y. *North American*.
730. Dr. JOHN G. THOMAS, Rivière-du-Loup-en-bas, Canada East. *Canadian*.
731. JOHN J. THOMAS, Union Springs, Cayuga Co., N. Y. *Local*.
732. Prof. GEORGE THURBER, Office, American Agriculturist, New York, N. Y. *North American*. Special, *Gramineæ*.
733. Prof. JOHN TORREY (Professor of Botany, Columbia College), New York, N. Y. *General*. Special, *North American*.
734. Dr. MORTON S. TOWNSHEND, Avon, Lorain Co., Ohio. *Local*.
735. C. M. TRACY (Curator of Botany, Essex Institute), Lynn, Mass. *General Collection*. Special, *New England*.
736. Prof. EDWARD TUCKERMAN (Professor of Botany, Amherst College), Amherst, Mass. *General*. Special, *Lichens*.
737. Dr. GEORGE VASEY, Richview, Washington Co., Ill. *North American*.
738. WM. S. VAUX (Vice President and Curator, Academy of Natural Sciences), No. 1700 Arch street, Philadelphia, Pa. *North American*.
739. Prof. A. E. VERRILL (Professor of Zoölogy, Yale College), New Haven, Ct. *New England*.
740. Dr. J. A. WARDER, Cincinnati, Ohio. *Local*.
741. G. WARRING, Boalsburg, Pa. *Local*.
742. DAVID A. P. WATT (Editor, Canadian Naturalist and Geologist), Montreal, Canada. *Canadian*. Special, *Fungi*.
743. Miss MARY WHITTINGTON, Harrodsburg, Ky. *Local*.
744. DANIEL WILKINS, Littleton, N. H. *Local*.
745. H. WILLEY, New Bedford, Mass. *Lichens*.
746. Prof. O. R. WILLIS, Whiteplains, N. Y. *North American*.
747. HUGH WILSON, Salem, Mass. *Horticultural*. Special, *Ferns under cultivation*.
748. NATHANIEL WILSON (Curator, Island Botanic Garden), Jamaica, W. I. *West Indian*.
749. N. H. WINCHELL, Ann Arbor, Mich. *Local*.
750. I. R. WIRT, McVeytown, Pa. *Local*.
751. W. WYNNE WISTAR, Germantown, Pa. *Local*.
752. JOHN WOLF, Canton, Fulton Co., Ill. *Local*.
753. Prof. ALPHONSO WOOD, Brooklyn, N. Y. *North American*.
754. Prof. H. C. WOOD, jr. (Professor of Botany, University of Pennsylvania), Philadelphia, Pa. *North American*.
755. CHARLES WRIGHT, Wethersfield, Ct. *General*. Special, *Cuba, Texas, and New Mexico*.

ARCHAEOLOGY.

- 756. T. A. CHENEY (Lib., Georgic Library), Havana, N. Y. *N. Am.*
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- 758. DR. SAMUEL A. GREENE, Boston, Mass. *North American.*
- 759. SAMUEL F. HAVEN (Secretary, American Antiquarian Society), Worcester, Mass. *North American.*
- 760. HON. I. A. LAPHAM, Milwaukee, Wis. *North American.*
- 761. REV. SAMUEL LOCKWOOD, Keyport, N. J. *New Jersey.*
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- 764. FRANKLIN PEALE, No. 1131 Girard street, Philadelphia, Pa. *North American.*
- 765. CHARLES RAU, New York, N. Y. *American.*
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- 767. E. GEORGE SQUIER, No. 105 East Thirty-ninth street, New York, N. Y. *American.*
- 768. WM. S. VAUX (Vice President and Curator, Academy of Nat. Sciences), No. 1700 Arch street, Philadelphia, Pa. *N. Am.*
- 769. COL. CHARLES WHITTLESEY, Cleveland, Ohio. *North American.*
- 770. DR. J. N. WILSON, Newark, Ohio. *Local.*
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- 772. PROF. JEFFRIES WYMAN (Professor of Comparative Anatomy and Physiology, Harvard University; President, Boston Society of Natural History), Cambridge, Mass. *General.*

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- 778. DR. J. C. NOTT, Mobile, Alabama. *General.*
- 779. PROF. HENRY S. PATTERSON, Philadelphia, Pa. *General.*
- 780. DR. CHARLES PICKERING, Boston, Mass. *General.*
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- 782. PROF. DANIEL WILSON (Professor of History and English Literature, University College), Toronto, C. W. *General.*
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784. Prof. LOUIS AGASSIZ (Professor of Zoölogy and Geology, Harvard University; Director and Curator, Museum of Comparative Zoölogy), Cambridge, Mass.
785. Prof. S. F. BAIRD (Assistant Secretary, Smithsonian Institution), Washington, D. C.
786. Prof. JAMES D. DANA (Professor of Geology and Mineralogy, Yale College), New Haven, Ct.
787. Prof. J. W. DAWSON (Principal, McGill University), Montreal, Canada.
788. Prof. JOSEPH LEIDY (Professor of Anatomy, University of Pennsylvania; Curator, Academy of Natural Sciences of Philadelphia), No. 1802 Filbert street, Philadelphia, Pa.
789. Prof. JEFFRIES WYMAN (Professor of Comparative Anatomy and Physiology, Harvard University; President, Boston Society of Natural History), Cambridge, Mass.

MAMMALS.

790. Dr. HARRISON ALLEN, Academy of Natural Sciences, Philadelphia, Pa. *Chiroptera*.
Rev. JOHN BACHMAN, Charleston, S. C. *North American*.
791. Prof. S. F. BAIRD (Assistant Secretary, Smithsonian Institution), Washington, D. C. *American*.
792. GEORGE BARNSTON, Montreal, Canada. *Local*.
793. Dr. G. A. CANFIELD, Monterey, Cal. *Californian*.
794. Dr. J. G. COOPER, (Zoölogist, California State Survey; Curator of Zoölogy, California Academy of Natural Sciences), San Francisco, Cal. *Californian*.
795. Prof. E. D. COPE (Curator, Academy of Natural Sciences), Philadelphia, Pa. *Cetacea*.
796. Dr. ELLIOTT COUES, U. S. A., Smithsonian Institution, Washington, D. C. *Arizonian*.
797. C. W. GILBERT (Assistant Curator of Mammalia, Worcester Society of Natural History), Worcester, Mass. *Local*.
798. Prof. THEO. GILL (Librarian, Smithsonian Institution), Washington, D. C. *General*.
799. Dr. JOHN GUNDLACH, Calle de la Reina, 61, Habana, Cuba. *Cuban*.
800. Hon. RICHARD HILL, Spanishtown, Jamaica. *Jamaican*.

801. W. HUNTER (Taxidermist, Natural History Society of Montreal), Montreal, Canada. *Local*.
802. NATHANIEL PAINE (Curator of Mammalia, Worcester Society of Natural History), Worcester, Mass. *Local*.
803. TITIAN R. PEALE, Washington, D. C. *General*.
804. Prof. FELIPE POEY, Calle del Agulla, 157, Habana, Cuba. *Cuban*.
805. F. W. PUTNAM (Superintendent, Essex Institute; Curator of Ichthyology, Boston Society of Natural History), Salem, Mass. *Essex County, Mass.*
806. T. T. RICHARDS, St. Louis, Mo. *Crania*.
807. BERNARD R. ROSS, Rupert House. *Arctic*.
808. E. A. SAMUELS, Office State Board of Agriculture, Boston. Mass. *Local*.
809. Dr. J. H. SLACK, No. 1701 Spruce street, Philadelphia, Pa. *Quadrumania*.
810. Dr. GEORGE SUCKLEY, U. S. A., New York, N. Y. *Washington Territory*.
811. Prof. A. E. VERRILL (Professor of Zoölogy, Yale College; Curator of Radiata, Boston Society of Natural History, Boston, Mass.), New Haven, Ct. *North American*.
812. Dr. J. C. WHITE (Curator of Comparative Anatomy and Mammalogy, Boston Society of Natural History), Boston, Mass. *Anatomy*.
813. J. F. WHITEAVES (Curator and Rec. Secretary, Natural History Society of Montreal), Montreal, Canada. *Local*.

BIRDS.*

814. JOHN AKHURST, No. 9½ Prospect street, Brooklyn, N. Y. *Local. Taxidermist and Dealer*.
815. J. A. ALLEN, Springfield, Mass. *New England*.
816. G. ALMA, Farmersville, Seneca Co., N. Y. *Local*.
817. Rev. JOHN AMBROSE, St. Margaret's Bay, Halifax Co., Nova Scotia. *Local*.
818. AMORY L. BABCOCK, Sherborn, Mass. *Surinam, S. A., and Local. Taxidermist*.
819. Prof. S. F. BAIRD (Assistant Secretary, Smithsonian Institution), Washington, D. C. *General. Special, American*.
820. VINCENT BARNARD, Kennett Square, Chester Co., Pa. *Local*.

* NOTE. Oölogy has now become so intimately connected with the study of the Birds themselves that about every person paying attention to Ornithology also has collections of the Eggs of Birds, therefore Oölogy, as a separate department, is omitted in the DIRECTORY.

821. GEORGE BARNSTON, Montreal, Canada. *Local*.
822. Rev. M. W. BEAUCHAMP, King's Ferry, Cayuga, Co., N. Y. *Local*.
823. S. B. BECKETT (Curator of Ornithology, Portland Society of Natural History), Portland, Me. *Local*.
824. JOHN G. BELL, No. 339 Broadway, New York, N. Y. *Taxidermist and Dealer*.
825. C. W. BENNETT (Curator of Ornithology, Museum of the Springfield City Library Association), Holyoke, Mass. *Local*.
826. Mrs. J. L. BODE, No. 16 North William street, New York, N. Y. *Taxidermist and Dealer*.
827. CHAS. L. BLOOD, Corner of Weir and First streets, Taunton, Mass. *Local. Taxidermist*.
828. G. A. BOARDMAN, Milltown, Me. *Local*.
829. S. H. BOWKER (Assistant Curator of Ornithology, Worcester Society of Natural History), Worcester, Mass. *Local*.
830. JOSEPH BRANO, Philadelphia, Pa. *Local. Taxidermist*.
831. Dr. T. M. BREWER (Curator of Oölogy, Boston Society of Natural History), Boston, Mass. *North American. Oölogy*.
832. C. G. BREWSTER, No. 16 Tremont street, Boston, Mass. *Dealer*.
833. E. A. BRIGHAM (Assistant Curator of Ornithology, Boston Society of Natural History), Boston, Mass. *Local*.
834. GEORGE C. BROWN (Curator and Treasurer, Burlington Co. Lyceum of Natural History), Mount Holly, N. J. *N. American*.
835. J. ELLIOTT CABOT (Curator of Ornithology, Boston Society of Natural History), Brookline, Mass. *General Collection*.
836. Dr. SAMUEL CABOT, Boston, Mass. *North American*.
837. R. A. CAMPBELL, Newark, Ohio. *Local*.
838. JOHN CASSIN (Vice President and Curator of Ornithology, Academy of Natural Sciences), Philadelphia, Pa. *General*.
839. RICHARD CHRIST, Nazareth, Pa. *Local*.
840. SAMUEL C. CLARK, Chicago, Ill. *North American*.
841. JOHN COLTON, Worcester, Mass. *Local*.
842. Dr. J. G. COOPER (Zoölogist, California State Survey; Curator of Zoölogy, California Academy of Natural Sciences), San Francisco, Cal. *Pacific Coast of N. A.*
843. THOMAS COTTLE, Woodstock, Canada West. *Local*.
844. Dr. ELLIOTT COUES, U. S. A., Smithsonian Institution, Washington, D. C. *American*.
845. WILLIAM COUPER (Vice President, Quebec Branch, Entomological Society of Canada), Quebec, Canada. *North American. Taxidermist*.
846. C. A. CRAIG, Montreal, Canada. *Local. Taxidermist*.

847. DR. JOHN DARBY, South Williamstown, Mass. *Local*.
848. HENRY DAVIS, McGregor, Iowa. *Local*.
849. J. C. DEACON, Chicopee, Mass. *Local. Taxidermist*.
850. RAFAEL MONTES DE OCA, Xalapa, Mexico. *Mexican*.
851. C. DREXLER, Washington, D. C. *Local. Taxidermist*.
852. D. G. ELLIOT, No. 27 West Thirty-third street, New York, N. Y. *American*.
853. SAMUEL E. ELMORE, Hartford, Ct. *Local*.
854. W. E. ENDICOTT, Canton, Mass. *New England*.
855. PROF. H. FAIRBANKS (Prof. of Natural Philosophy, Dartmouth College), Hanover, N. H. *North American*.
856. CHARLES FELDMAN, Philadelphia, Pa. *Local. Taxidermist*.
857. WM. H. FLOYD, Weston, Mass. *North American*.
858. AUGUSTUS FOWLER, Danvers, Mass. *Local*.
859. SAMUEL P. FOWLER (Vice President, Essex Institute, Salem), Danvers, Mass. *Local*.
860. DR. A. VON FRANTZIUS, San José, Costa Rica. *Costa Rican*.
861. ALEXANDER GALBRAISH, No. 209 North Ninth street, Philadelphia, Pa. *Local. Taxidermist and Dealer*.
862. CHARLES GALBRAITH, West Hoboken, N. J. *Local. Taxidermist*.
863. WM. GALBRAITH, West Hoboken, N. J. *Local. Taxidermist*.
864. WM. L. GILL, Lancaster, Pa. *Local*.
865. Col. A. J. GRAYSON, Mazatlan, Mexico. *Mexican*.
866. FERD. GRUBER, San Francisco, Cal. *Local. Taxidermist*.
867. DR. JOHN GUNDLACH, Calle de la Reina, 61, Habana, Cuba. *West Indian*.
868. Prof. C. E. HAMLIN (Professor of Natural History, Waterville College), Waterville, Me. *Maine*.
869. HENRY HANFORD, Columbus, Ohio. *Local*.
870. GEORGE HENSEL, Lancaster, Pa. *Local. Taxidermist*.
871. JAMES HEPBURN, San Francisco, Cal. *Western Coast of America*.
872. Dr. A. HALL, Montreal, Canada. *Local*.
873. Hon. RICHARD HILL, Spanishtown, Jamaica. *Local*.
874. THOMAS HOLE, Clarkson, Columbiana Co., Ohio. *Local*.
875. Dr. P. R. HOY, Racine, Wis. *Local*.
876. Dr. A. T. HUDSON, U. S. A., Lyons, Clinton Co., Iowa. *Local*.
877. D. DARWIN HUGHES, Marshall, Mich. *Local*.
878. CHAS. A. HOUGHTON, Holliston, Mass. *Local. Taxidermist*.
879. W. HUNTER (Taxidermist, Natural History Society of Montreal), Montreal, Canada. *Local*.
880. ILGES and SANTER, No. 15 Frankfort street, New York, N. Y. *Taxidermists*.

881. JOHN JENKINS, Monroe, Orange Co., N. Y. *Local. Taxidermist.*
882. SAMUEL JILLSON, Hudson, Mass. *Local. Taxidermist.*
883. Rev. C. M. JONES, North Madison, Ct. *Local.*
884. F. KEMPFFER, Chicago, Ill. *Local.*
885. JOHN KIRKPATRICK (Secretary, Academy of Natural Sciences of Cleveland; Secretary, Cleveland Horticultural Society), Cleveland, Ohio. *Local.*
886. Rev. A. B. KENDIG, Davenport, Iowa. *Local.*
887. Dr. JARED P. KIRTLAND, East Rockport, Ohio, P. O. address, Cleveland, Ohio. *Local.*
888. Miss H. M. KNOWLTON (Assistant Curator of Ornithology, Worcester Society of Nat. History), Worcester, Mass. *Local.*
889. JOHN KRIDER, Corner of Second and Walnut streets, Philadelphia, Pa. *North American. Taxidermist.*
890. THURE KUMLIEN, Busseyville P. O., Wis. *North American.*
891. GEORGE N. LAWRENCE, No. 172 Pearl street, New York, N. Y. *American.*
892. J. S. LEACH, Bridgewater, Mass. *Local.*
893. JAMES M. LEMOINE, Quebec, Canada. *Local.*
894. Miss F. S. LINCOLN (Curator of Oölogy, Worcester Society of Natural History), Worcester, Mass. *Local Oölogy.*
895. Dr. STARLING LORING, Columbus, Ohio. *Local.*
896. B. P. MANN, Cambridge, Mass. *Local Oölogy.*
897. WILLIAM T. MARCH, Spanishtown, W. I. *West Indian.*
898. Dr. ISAAC C. MARTINDALE (Director, Byberry Philosophical Society), Byberry, Pa. *Local.*
899. L. J. MAYNARD, Newtonville, Mass. *Local. Taxidermist.*
900. R. MCFARLANE, Fort Anderson, British America. *Northern Regions of America.*
901. THOMAS MCILWRAITH, Hamilton, C. W. *Local.*
902. Prof. MANLY MILES (Professor of Animal Physiology and Practical Agriculture, State Agricultural College), Lansing, Mich.
903. CHARLES H. NAUMAN (Chairman, Committee on Ornithology, Linnæan Society of Lancaster), Box 508, Lancaster, Pa. *Local.*
904. Dr. J. S. NEWBERRY (Professor of Geology, Columbia College), New York, N. Y. *North American.*
905. GEORGE Y. NICKERSON, No. 42 Williams street, New Bedford, Mass. *Local. Taxidermist.*
906. J. P. NORRIS, Philadelphia, Pa. *Local.*
907. CHARLES S. PAINE, East Bethel, Vt. *Local.*
908. FREDERICK PASSMORE, Yonge street, Toronto, C. W. *North American.*

909. TITIAN R. PEALE, Washington, D. C. *General*.
910. Dr. D. WEBSTER PRENTISS, Washington, D. C. *Local*.
911. HENRY A. PURDIE, Boston, Mass. *Local*.
912. F. W. PUTNAM (Superintendent, Essex Institute; Curator of Ichthyology, Boston Society of Natural History), Salem, Mass. *Essex County, Mass.*
913. L. E. RICKSECKER, Nazareth, Pa. *Local*.
914. O. RIENECKE (Curator of Ornithology, Buffalo Society of Natural Sciences), Buffalo, N. Y. *Local*.
915. A. H. RISE, St. Thomas, W. I. *West Indian*.
916. JAMES S. ROGERS, New York, N. Y. *Local*.
917. JAMES H. ROOME, No. 55 Carmine street, New York, N. Y. *Local. Taxidermist*.
918. BERNARD R. ROSS, Rupert House. *Arctic*.
919. WILLIAM A. ROUSSEAU, Troy, N. Y. *Local*.
920. E. A. SAMUELS, Office State Board of Agriculture, Boston, Mass. *New England. North American Oölogy*.
921. Dr. C. SARTORIUS, Mirador, Mexico. *Mexican*.
922. LIVINGSTON SATTERLEE, New York, N. Y. *Local*.
923. JOHN H. SEARS, Danvers, Mass. *Essex County, Mass.*
924. HENRY SHAW (Assistant Curator of Ornithology, Worcester Society of Natural History), Worcester, Mass. *Local*.
925. — SHERMAN, Bedford street, New Bedford, Mass. *Local*.
926. Prof. HENRY SHIMER, Mt. Carroll, Ill. *Local*.
927. JAMES G. SHUTE, Woburn, Mass. *Local*.
928. S. I. SMITH, New Haven, Ct. *New England*.
929. WILLIAM A. SMITH (Curator of Ornithology, Worcester Society of Natural History), Worcester, Mass. *Local*.
930. Rev. WM. S. SOUTHGATE, Litchfield, Ct. *Local*.
931. JACOB STAUFFER (Secretary, Linnæan Society of Lancaster), Lancaster, Pa. *Local*.
932. Rev. JAMES STEPHENSON, St. Inigos, St. Mary's Co., Md. *Local*.
933. Dr. GEORGE SUCKLEY, U. S. A., New York, N. Y. *North American*.
934. JOSEPH SULLIVANT, Columbus, Ohio. *Local*.
935. Prof. F. SUMICHRIST, Orozaba, Mexico. *Mexican*.
936. E. L. SUMNER (Assistant Curator of Oölogy, Worcester Society of Natural History), Worcester, Mass. *Local*.
937. S. H. SYLVESTER, Middleborough, Mass. *Local. Tuxidermist*.
938. JAMES TAYLOR, Philadelphia, Pa. *Local. Taxidermist*.
939. T. MARTIN TRIPPE, Orange, N. Y. *Local*.
940. H. G. VERNOR, Montreal, Canada. *Local*.

941. Dr. VELIE, Bath, Steuben Co., N. Y. *North American*.
 942. Prof. A. E. VERRILL (Professor of Zoölogy, Yale College; Curator of Radiata, Boston Society of Natural History), New Haven, Ct. *North American*.
 943. NATHANIEL VICKARY, No. 262 Chestnut street, Lynn, Mass. *Local. Taxidermist and Dealer*.
 944. FREDERIC WARE, Cambridge, Mass. *Local*.
 945. JOHN M. WHEATON, Columbus, Ohio. *Local*.
 946. J. F. WHITEAVES (Recording Secretary and Curator, Natural History Society of Montreal), Montreal, Canada. *Canadian*.
 947. Prof. WM. D. WHITNEY (Professor of Sanskrit, Yale College), New Haven, Ct. *New England*.
 948. ROBERT WILSON, Gouverneur, N. Y. *Local*.
 949. R. K. WINSLOW, Cleveland, Ohio. *Local*.
 950. ALEXANDER WOLLE, Baltimore, Md. *Local. Taxidermist*.
 951. C. J. WOOD, Philadelphia, Pa. *Local. Taxidermist*.
 952. Dr. WM. WOOD, East Windsor Hill, Ct. *Local*.

REPTILES.

953. Prof. LOUIS AGASSIZ (Professor of Zoölogy and Geology, Harvard University; Director and Curator, Museum of Comparative Zoölogy), Cambridge, Mass. *General. Special, Chelonia*.
 954. Prof. S. F. BAIRD (Assistant Secretary, Smithsonian Institution), Washington, D. C. *General Collection. Special, N. American*.
 955. Prof. EDWARD D. COPE (Curator, Academy of Natural Sciences of Philadelphia), Philadelphia, Pa. *General*.
 956. Dr. B. F. FOGG (Curator of Herpetology, Portland Society of Natural History), Portland, Me. *Local*.
 957. Prof. J. E. HOLBROOK, Charleston, S. C. *North American*.
 958. Prof. JOHN LE CONTE (Professor of Natural Philosophy, University of South Carolina), Columbia, S. C. *Local*.
 959. Prof. JOSEPH LEIDY (Professor of Anatomy, University of Pennsylvania; Curator, Academy of Natural Sciences), No. 1302 Filbert street, Philadelphia, Pa. *Fossil*.
 960. Prof. O. C. MARSH (Professor of Palæontology, Yale College), New Haven, Ct. *Fossil*.
 961. Prof. J. S. NEWBERRY (Professor of Geology, Columbia College), New York, N. Y. *Fossil*.
 962. F. W. PUTNAM (Superintendent, Essex Institute; Curator of Ichthyology, Boston Society of Natural History; Editor, American Naturalist), Salem, Mass. *General Collection. Special, North American*.

963. STEPHEN SALISBURY, jr. (Curator of Herpetology, Worcester Society of Natural History), Worcester, Mass. *Local*.
964. JACOB STAUFFER (Secretary, Linnæan Society of Lancaster), Lancaster, Pa. *Local*.
965. Prof. A. E. VERRILL (Professor of Zoölogy, Yale College; Curator of Radiata, Boston Society of Natural History), New Haven, Ct. *North American*.
966. Dr. B. G. WILDER (Professor of Natural History, Cornell University; Curator of Herpetology, Boston Society of Natural History; Assistant, Museum of Comp. Zoölogy), Boston, Mass. *General Collection*.
967. HENRY S. WILLIAMS, Ithaca, N. Y. *Local*.
968. Prof. ALEXANDER WINCHELL (Professor of Natural History, University of Michigan), Ann Arbor, Mich. *Local*.
969. Dr. T. G. WORMLEY, Columbus, Ohio. *Local*.

FISHES.

970. Dr. C. C. ABBOTT (Zoölogist, New Jersey State Survey), Trenton, N. J. *Local*.
971. ALEX. E. R. AGASSIZ (Assistant, Museum of Comparative Zoölogy), Cambridge, Mass. *Embiotocoids*.
972. Prof. LOUIS AGASSIZ (Professor of Zoölogy and Geology, Harvard University; Curator and Director, Museum of Comparative Zoölogy), Cambridge, Mass. *General*.
973. G. ALMA, Farmersville, Seneca Co., N. Y. *Local*.
974. Rev. JOHN AMBROSE, St. Margaret's Bay, Halifax Co., Nova Scotia. *Local*.
975. CHARLES G. ATKINS (Commissioner of River Fisheries), Augusta, Me. *Fishculture*.
976. Capt. N. E. ATWOOD, Provincetown, Mass. *Local. Food Fishes*.
977. Dr. W. O. AYRES (Corresponding Secretary, California Academy of Natural Sciences), San Francisco, Cal. *Californian*.
978. Prof. S. F. BAIRD (Assistant Secretary, Smithsonian Institution), Washington, D. C. *North American*.
979. Rev. M. W. BEAUCHAMP, King's Ferry, Cayuga, N. Y. *Local*.
980. J. CARSON BREVOORT (President, Long Island Historical Society), Brooklyn, N. Y. *General*.
981. Dr. ROBERT BRIDGES, Philadelphia, Pa. *Local*.
982. SAMUEL C. CLARK, Chicago, Ill. *Local*.
983. J. D. COOPER, San Francisco, Cal. *Californian*.
984. Prof. EDWARD D. COPE (Curator, Academy of Natural Sciences of Philadelphia), Philadelphia, Pa. *General Collection. Special, North American Fresh-water*.

985. Dr. J. W. DAWSON (Principal, McGill University), Montreal, Canada. *Local and Fossil*.
986. ANDREW GARRETT, Care of Samuel Hubbard, Agent Pacific Mail Steamship Co., San Francisco, Cal. *South Seas*.
987. Dr. W. P. GIBBONS, Alameda Co., Cal. *Embiotocoids*.
988. Prof. THEODORE GILL (Librarian, Smithsonian Institution), Washington, D. C. *General*.
989. Dr. J. BERNARD GILPIN (Vice President, Nova Scotian Institute of Natural Science), Halifax, Nova Scotia. *Nova Scotian*.
990. Dr. A. C. HAMLIN, Bangor, Me. *Salmonidæ of Maine*.
991. Hon. RICHARD HILL, Spanishtown, Jamaica. *West Indian*.
992. Prof. J. E. HOLBROOK, Charleston, S. C. *Southern States*.
993. J. MATTHEW JONES, Ashbourne, Nova Scotia. *Nova Scotian*.
994. Dr. J. P. KIRTLAND, East Rockport, Ohio; Post-office address, Cleveland, Ohio. *Great Lakes and Ohio*.
995. Prof. JOSEPH LEIDY (Professor of Anatomy, University of Pennsylvania; Curator, Academy of Natural Sciences), No. 1802 Filbert street, Philadelphia, Pa. *Fossil*.
996. Rev. SAMUEL LOCKWOOD, Keyport, N. J. *Local*.
997. THEODORE LYMAN (Assistant, Museum of Comp. Zoölogy, Cambridge; Commissioner of River Fisheries), Brookline, Mass. *Fishculture*.
998. Dr. R. P. MANN, Milford, Ohio. *Devonian*.
999. H. A. MARSH (Assistant Curator of Ichthyology, Worcester Society of Natural History), Worcester, Mass. *Local*.
1000. Prof. O. C. MARSH (Professor of Palæontology, Yale College), New Haven, Ct. *Fossil*.
1001. Dr. J. C. MORRIS, Philadelphia, Pa. *Local*.
1002. Dr. WILLIAM A. NASON, Post-office box 8412, Chicago, Ill. *Local*.
1003. Prof. J. S. NEWBERRY (Professor of Geology, Columbia College), New York, N. Y. *Fossil*.
1004. THADDEUS NORRIS, 505 Minor st., Philadelphia, Pa. *Game Fishes*.
1005. Prof. FELIPE POEY, Calle del Aguila, 157, Habana, Cuba. *West*
1006. M. N. PRESTON, Skaneateles, N. Y. *Local*. [*Indian*]
1007. F. W. PUTNAM (Superintendent, Essex Institute; Curator of Ichthyology, Boston Society of Natural History; Editor, American Naturalist), Salem, Mass. *General*.
1008. O. H. ST. JOHN, Waterloo, Iowa. *Fossil*.
1009. S. H. SCUDDER (Custodian, Secretary, Librarian, and Curator of Entomology, Boston Society of Natural History), Cambridge, Mass. *Hamulidæ*.
1010. H. L. SHUMWAY (Assistant Curator of Ichthyology, Worcester Society of Natural History), Worcester, Mass. *Local*.

1011. Dr. D. H. STORER, Boston, Mass. *Massachusetts*.
1012. Dr. GEORGE SUCKLEY, U. S. A., New York, N. Y. *Salmonidae*.
1013. Dr. B. G. WILDER (Professor of Natural History, Cornell University; Assistant, Museum of Comparative Zoölogy; Curator of Herpetology, Boston Society of Natural History), Boston, Mass. *Selachians*.
1014. Prof. ALEXANDER WINCHELL (Professor of Natural History, University of Michigan), Ann Arbor, Mich. *North American and Fossil*.
1015. J. W. YOUNG, Cleveland, Ohio. *Local*.

INSECTS.

1016. CHARLES E. AARON, Mount Holly, N. J. *Local*.
1017. ALVEY A. ADEE, No. 54 Exchange Place, New York, N. Y. *Hymenoptera*.
1018. A. E. R. AGASSIZ (Assistant, Museum of Comparative Zoölogy), Cambridge, Mass. *General. Special, Lepidoptera*.
1019. Prof. LOUIS AGASSIZ (Professor of Zoölogy and Geology, Harvard University; Curator and Director, Museum of Comparative Zoölogy), Cambridge, Mass. *General*.
1020. JOHN AKHURST, No. 9½ Prospect street, Brooklyn, N. Y. *Coleoptera*.
1021. W. P. ALCOTT, Andover, Mass. *Local*.
1022. J. A. ALLEN, Springfield, Mass. *Local*.
1023. JAMES ANGUS, West Farms, N. Y. *Hymenoptera and Lepidoptera*.
1024. T. B. ASHTON, North White Creek, Washington Co., N. Y. *Local*.
1025. E. P. AUSTIN, Cambridge, Mass. *Coleoptera*.
1026. SAMUEL AUXER, Lancaster, Pa. *Local*.
1027. AMORY L. BABCOCK, Sherborn, Mass. *Local, and Surinam, S. A.*
1028. AUSTIN BACON, Natick, Mass. *Local*.
1029. VINCENT BARNARD, Kennett Square, Chester Co., Pa. *Local*.
1030. HOMER F. BASSETT, Waterbury, Ct. *N. American Hymenoptera*.
1031. D. W. BEADLE, St. Catharines, Canada West. *Local Coleoptera and Lepidoptera*.
1032. Dr. H. BEHR (Entomologist, California State Board of Agriculture), San Francisco, Cal. *Californian*.
1033. JAMES S. BEHRENS, San Francisco, Cal. *Coleoptera and Lepidoptera*.
1034. G. W. BELFRAGE, Chicago, Ill. *A Collector*.
1035. AARON B. BELKNAP, New York, N. Y. *Local*.
1036. J. F. BENNER, New Lisbon, Ohio. *Local*.
1037. C. W. BENNETT, Holyoke, Mass. *Local*.

1038. Rev. CHARLES J. S. BETHUNE (Secretary and Treasurer, Entomological Society of Canada), Credit, Canada West. *Canadian Coleoptera, and North American Lepidoptera.*
1039. B. BILLINGS, Ottawa City, Canada West. *Local.*
1040. E. BILLINGS. Montreal, Canada. *Coleoptera.*
1041. CHARLES A. BLAKE, Philadelphia, Pa. *Local Lepidoptera.*
1042. M. P. BLAKE, Gilmanton, N. H. *Local.*
1043. J. H. B. BLAND, Philadelphia, Pa. *North American Coleoptera.*
1044. Col. J. H. BLISS, Erie, Pa. *Local.*
1045. CHARLES L. BLOOD, Corner of Weir and First streets, Taunton, Mass. *Local.*
1046. ANDREW BOLTER, Corner of Wells and Van Buren streets, Chicago, Ill. *Lepidoptera.*
1047. JOHN BOLTON, Portsmouth, Ohio. *Local.*
1048. — BOTTIN, Orizaba, Mexico. *Mexican.*
1049. GEORGE J. BOWLES (Secretary, Quebec Branch, Entomological Society of Canada; Curator, Literary and Historical Society of Quebec), Quebec, Canada. *North American Lepidoptera.*
1050. FREDERICK BRACHES, Gray's Summit, Franklin Co., Mo. *Local.*
1051. GEORGE E. BRACKETT, Belfast, Me. *Local.*
1052. Rev. J. H. BRAKELEY, Bordentown, N. J. *Local.*
1053. Rev. W. B. BREED, Philadelphia, Pa. *Local.*
1054. Dr. EMIL BRENDEL, U. S. A., Peoria, Ill. *Pselaphids.*
1055. JOSEPH BRIDGHAM, Jr., No. 26 Waverly Place, New York, N. Y. *North American Lepidoptera.*
1056. Mrs. JOSEPH BRIDGHAM, No. 26 Waverly Place, New York, N. Y. *Local.*
1057. ROBERT H. BROWNE, Quebec, Canada. *N. American Lepidoptera,*
1058. S. B. BUCKLEY, Geological Bureau, Austin, Texas. *Local. Formicidae.*
1059. ROBERT BUNKER, Rochester, N. Y. *Local.*
1060. EDWARD BURGESS, Boston, Mass. *Local.*
1061. STEPHEN CALVERLY, Brooklyn, N. Y. *Local.*
1062. WILLIAM W. CAREY, Colerain, Mass. *Apiarian.*
1063. DAVID A. CASHMAN, Chicago, Ill. *Local.*
1064. H. H. CHAPMAN, Chicago, Ill. *Local.*
1065. JOSEPH E. CHASE, Holyoke, Mass. *Local.*
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1067. Rev. V. CLEMENTI, North Douro, Canada West. *Local.*
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1070. WILLIAM COUPER (Vice President, Quebec Branch, Entomological Society of Canada), Quebec, Canada. *Coleoptera and Insect Architecture.*
1071. E. T. CRESSON (Corresponding Secretary and Curator, American Entomological Society), No. 518 South Thirteenth street, Philadelphia, Pa. *General. Special, Hymenoptera.*
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1074. W. O. CURRIER, Providence, R. I. *Local.*
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1076. A. W. DE FOREST, New York, N. Y. *North American.*
1077. THOMAS A. DICKINSON, Worcester, Mass. *Local.*
1078. GEORGE B. DIXON, (Librarian, American Entomological Society), Philadelphia, Pa. *General.*
1079. CHARLES R. DODGE (Assistant in Entomology, U. S. Department of Agriculture), Washington, D. C. *Local.*
1080. Dr. EDWARD DORSCH, Monroe, Mich. *Local.*
1081. WILLIAM H. EDWARDS, Newburgh, N. Y. *North American Lepidoptera.*
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1086. FRANK FAIRBANKS, St. Johnsbury, Vt. *Local.*
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1088. WALTER FAXON, Jamaica Plain, Mass. *Local.*
1089. H. TUDOR FAY, Columbus, Ohio. *North American Coleoptera.*
1090. HENRY FELDMAN, Philadelphia, Pa. *Local Coleoptera.*
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1093. D. M. FISK, Brown University, Providence, R. I. *Local.*
1094. Dr. ASA FITCH (State Entomologist of New York), Salem, Washington Co., N. Y. *General. Special, Injurious and Beneficial.*
1095. C. FOLEY, Lindsay, Canada West. *Local.*
1096. R. J. FOWLER, Montreal, Canada. *Lepidoptera.*
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1099. Dr. G. P. GIRDWOOD, Montreal, Canada. *Local.*

1100. TOWNEND GLOVER (Entomologist, U. S. Department of Agriculture), Washington, D. C. *North American*.
1101. EDWARD L. GRAEF (Member of Committee on Entomology, Long Island Historical Society), Brooklyn, N. Y. *North American and European Lepidoptera*.
1102. DR. JOHN W. GREENE (Curator, Lyceum of Natural History of New York), No. 7 West Fifteenth street, New York, N. Y. *North American Hymenoptera*.
1103. AUGUSTUS R. GROTE (Curator of Entomology, Buffalo Society of Natural Science), No. 41 Beaver street, New York, N. Y. *North American Lepidoptera*.
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1105. Miss C. GUILD, Walpole, Mass. *Local*.
1106. DR. JUAN GUNDLACH, Habana, Cuba. *Cuban*.
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1108. REUBEN HAINES, Germantown, Pa. *Lepidoptera*.
1109. Prof. S. S. HALDEMAN, Columbia, Pa. *N. American Coleoptera*.
1110. DR. A. HALL, Montreal, Canada. *Local*.
1111. GEORGE H. HATHEWAY, Post-office box 5868, Chicago, Ill. *North American Hemiptera and Neuroptera*.
1112. DR. G. W. HAZLETINE, Jamestown, N. Y. *Local*.
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1116. DR. GEORGE H. HORN (President, American Entomological Society), Academy of Natural Sciences, Philadelphia, Pa. *North American Coleoptera*.
1117. WINSLOW J. HOWARD, No. 345 Grand street, New York, N. Y. *Local*.
1118. ROBERT HOWELL, Nichols, Tioga Co., N. Y. *Local*.
1119. CHARLES N. HOYT, Providence, R. I. *Local*.
1120. Rev. JAMES HUBBERT (Professor of Natural Sciences, St. Francis College), Richmond, Canada East. *Diptera*.
1121. GEORGE HUNT, Providence, R. I. *North American*.
1122. Miss M. E. HUNT, Providence, R. I. *Local*.
1123. Miss M. L. JENKS (Assistant Curator of Articulata, Worcester Society of Natural History), Worcester, Mass. *Local*.
1124. Rev. W. A. JOHNSON, Weston, Canada West. *Local*.
1125. J. MATTHEW JONES, Ashbourne, Nova Scotia. *Local*.
1126. Prof. SAMUEL JONES (Professor of Natural Sciences, Jefferson College), Canonsburg, Pa. *Local*.
1127. WILLIAM KEOSTLIN, New York, N. Y. *Coleoptera*.

1128. Rev. P. P. KIDDER, Ellicottsville, N. Y. *Local*.
1129. JOHN KIRKPATRICK (Secretary, Academy of Natural Sciences of Cleveland; Secretary, Cleveland Horticultural Society), Cleveland, Ohio. *Local*.
1130. Dr. J. P. KIRTLAND, East Rockport, Ohio; Post-office address, Cleveland, Ohio. *Local Lepidoptera*.
1131. J. FRANK KNIGHT (Recording Secretary, American Entomological Society), Philadelphia, Pa. *North American Homoptera*.
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1135. Dr. JOHN L. LE CONTE, No. 1325 Spruce street, Philadelphia, Pa. *Coleoptera*.
1136. Dr. JAMES LEWIS, Mohawk, N. Y. *Local*.
1137. Dr. SAMUEL LEWIS, No. 1830 Spruce street, Philadelphia, Pa. *North American Coleoptera*.
1138. Dr. G. LINCEUM, Long Point, Texas. *Local*.
1139. J. A. LINTNER, Utica, N. Y. *Lepidoptera*.
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1141. B. P. MANN, Cambridge, Mass. *Local*.
1142. Prof. R. Z. MASON, Appleton, Wis. *Local*.
1143. JAMES W. MCALLISTER (Treasurer, American Entomological Society), Philadelphia, Pa. *Hymenoptera*.
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1147. JAMES C. MERRILL, Pemberton Square, Boston, Mass. *Local*.
1148. JULIUS E. MEYER, Brooklyn, N. Y. *Lepidoptera*.
1149. Prof. MANLY MILES (Professor of Animal Physiology and Practical Agriculture, State Agricultural College), Lansing, Mich. *Local*.
1150. Rev. J. G. MORRIS, Baltimore, Md. *North American Lepidoptera*.
1151. Dr. WILLIAM A. NASON, Post-office Box 8412, Chicago, Ill. *Local Coleoptera*.
1152. JAMES NEAL, Cleveland, Ohio. *Local*.
1153. GEORGE W. NICHOLS, West Amesbury, Mass. *Local*.
1154. J. NIETS, Cordova, Mexico. *Local*.
1155. D. BENJAMIN NORRIS, Pittsfield, Pike Co., Ill. *Local*.
1156. EDWARD NORTON, Farmington, Ct. *General. Special, North American Hymenoptera*.
1157. JOHN ORNE, Jr., Cambridgeport, Mass. *N. American Coleoptera*.

1158. JOHN OSGOOD, Lynn, Mass. *Local*.
1159. BARON R. VON OSTEN SACKEN (Russian Consul General), No. 52 Exchange Place, New York, N. Y. *Diptera. Cynipidæ*.
1160. DR. A. S. PACKARD, jr. (Curator of Crustacea, Boston Society of Natural History; Curator of Articulata, Essex Institute; Editor, American Naturalist), Salem, Mass. *General. Special, Hymenoptera and Lepidoptera*.
1161. TITIAN R. PEALE, Washington, D. C. *Lepidoptera*.
1162. CHARLES H. PECK, Albany, N. Y. *Local*.
1163. GEORGE WM. PECK, No. 26 Dey street, New York, N. Y. *North American Lepidoptera*.
1164. JOHNSON PETTIT, Grimsby, Canada West. *Local Coleoptera and Lepidoptera*.
1165. WM. S. PINE (Vice President, American Entomological Society), Philadelphia, Pa. *Local*.
1166. JAMES H. POE, Portsmouth, Ohio. *Local*.
1167. PROF. FELIPE POEY, Calle del Aguila, No. 157, Habana, Cuba. *Cuban Neuroptera and Formicidæ*.
1168. S. S. RATHVON, Lancaster, Pa. *Coleoptera*.
1169. TRYON REAKIRT, No. 353 North Third street, Philadelphia, Pa. *Diurnal Lepidoptera*.
1170. A. S. REBER, Bellefonte, Pa. *Local*.
1171. E. BAYNES REED (Secretary, London Branch, Entomological Society of Canada), London, C. W. *Local*.
1172. T. REYNOLDS, Montreal, Canada. *Local*.
1173. HARVEY J. RICH, Brooklyn, N. Y. *Local*.
1174. WM. J. RICHARDSON, Oxford, Miss. *Local*.
1175. JAMES RIDINGS, Philadelphia, Pa. *General*.
1176. JAMES H. RIDINGS, Philadelphia, Pa. *North American Neuroptera and Orthoptera*.
1177. A. H. RIISE, St. Thomas, West Indies. *West Indian*.
1178. C. V. RILEY, Chicago, Ill. *Local. Injurious to Vegetation*.
1179. A. S. RITCHIE, Montreal, Canada. *Local*.
1180. COLEMAN T. ROBINSON, New York, N. Y. *N. Am. Lepidoptera*.
1181. DR. G. O. ROGERS, Lancaster, N. H. *Local*.
1182. WILLIAM A. ROUSSEAU, Troy, N. Y. *Local*.
1183. ALEX. L. RUSSELL, Quebec, Canada. *North American Lepidoptera*.
1184. J. SACHS, West Hoboken, N. J. *Local*.
1185. PROF. A. SAGER (Professor of Obstetrics, University of Michigan), Ann Arbor, Mich. *Local*.
1186. JAMES SAMPSON, New Harmony, Ind. *Local*.
1187. F. G. SANBORN, Boston Society of Natural History, Boston, Mass. *North American*.

1188. Dr. E. SANGER, Littleton, N. H. *Local*.
1189. Dr. JOHN H. SANGSTER, Normal School, Toronto, C. W. *Local*.
1190. Dr. C. SARTORIUS, Mirador, Mexico. *Mexican*.
1191. WILLIAM SAUNDERS, Dundas street, London, Canada West.
North American Coleoptera and Lepidoptera.
1192. MAURICE SHUSTER, St. Louis, Mo. *North American Coleoptera*.
1193. S. H. SCUDDER (Custodian, Secretary, Librarian, and Curator of
Entomology, Boston Society of Natural History), Cambridge,
Mass. *General. Special, Orthoptera. Diurnal Lepidoptera.*
Fossil Insects.
1194. Dr. WILLIAM SHARPSWOOD, Philadelphia, Pa. *Coleoptera and*
Arachnides.
1195. Prof. HENRY SHIMER, Mt. Carroll, Ill. *Local*.
1196. GEORGE D. SMITH, No. 162 Washington street, Boston, Mass.
Coleoptera.
1197. RUFUS SMITH, North Littleton, N. H. *Local*.
1198. S. I. SMITH (Assistant, Museum of Yale College), New Haven,
Ct. *North American. Special, Orthoptera*.
1199. Dr. WILLIAM M. SMITH, Manlius, N. Y. *Local*.
1200. CHARLES SONNE, No. 47 La Salle street, Chicago, Ill. *North*
American Coleoptera.
1201. Miss JULIA H. SPEAR, Burlington, Vt. *Local*.
1202. H. S. SPRAGUE, Buffalo, N. Y. *Local*.
1203. PHILIP S. SPRAGUE, Dorchester, Mass. *Local*.
1204. Mrs. PHILIP S. SPRAGUE, Dorchester, Mass. *Local*.
1205. PHILANDER M. SPRINGER, Springfield, Ill. *Local*.
1206. SOLOMON STEBBINS, Springfield, Mass. *General. Special, Diptera*.
1207. E. SUFFERT, Matanzas, Cuba. *Lepidoptera*.
1208. Prof. F. SUMICHRAST, Orizaba, Mexico. *Local*.
1209. ROBERT B. TALBOTT, New York, N. Y. *Local*.
1210. EDWARD TATNALL, jr., Wilmington, Del. *Coleoptera*.
1211. ALEX. S. TAYLOR, Santa Barbara, Cal. *Local*.
1212. Prof. SANBORN TENNEY (Professor of Natural Science, Vassar
Female College), Poughkeepsie, N. Y. *Local*.
1213. F. W. TEPPER, Brooklyn, N. Y. *Local*.
1214. JOHN TEPPER, Brooklyn, N. Y. *Local*.
1215. D. O. THIEME, Burlington, Iowa. *Local*.
1216. CYRUS THOMAS, Murphysboro', Ill. *North American Orthoptera*.
1217. Prof. D. G. THOMPSON (Professor of Natural Sciences, Otterbein
University), Westerville, Franklin Co., Ohio. *Local*.
1218. EDWARD F. TOLMAN (Assistant Curator of Articulata, Worces-
ter Society of Natural History), Worcester, Mass. *Local*.
1219. Dr. NORTON S. TOWNSHEND, Avon, Lorain Co., Ohio. *Local*.

1220. JAMES O. TREAT, Lawrence, Mass. *Local Lepidoptera*.
1221. DR. ISAAC P. TRIMBLE (State Entomologist of New Jersey), Newark, N. J. *Local. Beneficial and Injurious*.
1222. L. TROUVELOT, East Medford, Mass. *Local. Special, Silk producing Bombycidae. Zoölogical Artist*.
1223. WILLIAM TUPPER, Brooklyn, N. Y. *Lepidoptera*.
1224. P. R. UHLER (Peabody Institute), Baltimore, Md. *General. Special, Hemiptera and Neuroptera*.
1225. HENRY ULKE, Washington, D. C. *North American Coleoptera*.
1226. PROF. A. E. VERRILL (Professor of Zoölogy, Yale College; Curator of Radiata, Boston Society of Natural History), New Haven, Ct. *Injurious and Beneficial*.
1227. SAMUEL WAGNER (Editor Bee Gazette), Washington, D.C. *Apian*.
1228. BENJ. D. WALSH, Rock Island, Ill. *General. Special, Neuroptera and Cynipidæ*.
1229. REV. MR. WASSALL, Newburyport, Mass. *Lepidoptera*.
1230. J. W. WEDEMEYER, No. 75 Gold street, New York, N. Y. *Lepidoptera*.
1231. MRS. H. W. WELLINGTON, West Roxbury, Mass. *Local*.
1232. REV. DAVID WESTON (Curator of Articulata, Worcester Society of Natural History), Worcester, Mass. *Local*.
1233. C. P. WHITNEY, Milford, N. H. *Local*.
1234. J. P. WILDE, Egg Harbor, N. J., in summer; Baltimore, Md., in winter. *Coleoptera*.
1235. ——— WILDEBOER, Fontanelle, Barbadoes. *Local. A Collector and Dealer*.
1236. DR. S. C. WILLIAMS, Silver Springs, Lancaster Co., Pa. *Local*.
1237. CHARLES WILT, No. 1306 South street, Philadelphia, Pa. *General*.
1238. PROF. ALEXANDER WINCHELL (Professor of Natural History, University of Michigan, Ann Arbor, Mich. *North American Lepidoptera, Coleoptera, and Hymenoptera*.
1239. DR. HORATIO C. WOOD, jr. (Professor of Botany, University of Pennsylvania), Academy of Natural Sciences, Philadelphia, Pa. *North American Myriapoda and Arachnides*.
1240. WILLIAM S. WOOD, No. 61 Walker street, New York, N. Y. *Coleoptera*.
1241. REV. DANIEL ZIEGLER, York, Pa. *North American Coleoptera*.

CRUSTACEANS.

1242. PROF. LOUIS AGASSIZ (Professor of Zoölogy and Geology, Harvard University; Director and Curator, Museum of Comparative Zoölogy), Cambridge, Mass. *General*.

1243. CALEB COOKE (Curator of Articulata, Essex Institute), Salem, Mass. *Local*.
1244. Prof. JAMES D. DANA (Professor of Geology and Mineralogy, Yale College), New Haven, Ct. *General*.
1245. C. B. FULLER, Portland, Me. *Local*.
1246. ANDREW GARRETT, care of Samuel Hubbard, San Francisco, Cal. *South Seas*.
1247. Prof. L. R. GIBBES, Charleston, S. C. *Southern Coast*.
1248. Prof. THEODORE GILL (Librarian, Smithsonian Institution), Washington, D. C. *North American*.
1249. C. FRED. HARTT, Cooper Institute, New York, N. Y. *Trilobites*.
1250. Prof. O. C. MARSH (Professor of Paleontology, Yale College), New Haven, Ct. *Fossil*.
1251. F. B. MEEK, Smithsonian Institution, Washington, D. C. *Fossil*.
1252. Gen. ALBERT ORDWAY, Richmond, Va. *General*.
1253. Dr. A. S. PACKARD, jr. (Curator of Crustacea, Boston Society of Natural History; Curator of Articulata, Essex Institute; Editor, American Naturalist), Salem, Mass. *General*. Special, *North Atlantic*. [*Cuban*.
1254. Prof. FELIPE POEY, Calle del Agulla, No. 157, Habana, Cuba.
1255. Dr. EDMUND RAVENEL, Charleston, S. C. *Local and Fossil*.
1256. S. I. SMITH (Assistant in Zoölogy, Yale College), New Haven, Ct. *General*.
1257. Dr. WILLIAM STIMPSON (Secretary, and Director of the Museum, Chicago Academy of Sciences), Chicago, Ill. *General*.

WORMS.

1258. A. E. R. AGASSIZ (Assistant, Museum of Comparative Zoölogy), Cambridge, Mass. *Marine*.
1259. Prof. JOSEPH LEIDY (Professor of Anatomy, University of Pennsylvania; Curator, Academy of Natural Sciences), No. 1802 Filbert street, Philadelphia, Pa. *Parasites*.
1260. WILLIAM C. MINOR, New Haven, Ct. *Marine, Local*.
1261. Dr. A. S. PACKARD, jr. (Curator of Crustacea, Boston Society of Natural History; Curator of Articulata, Essex Institute; Editor, American Naturalist), Salem, Mass. *North Atlantic*.
1262. Dr. WILLIAM STIMPSON (Secretary and Director of the Museum, Chicago Academy of Sciences), Chicago, Ill. *Marine*.
1263. Dr. F. R. STURGIS, No. 103 Ninth street, New York, N. Y. *Helminths*.
1264. Prof. A. E. VERRILL (Professor of Zoölogy, Yale College; Curator of Radiata, Boston Society of Natural History), New Haven, Ct. *Local*.

1265. Dr. J. C. WHITE (Professor of ———, Mass. Medical College; Curator of Mammalia and Comparative Anatomy, Boston Society of Natural History), Boston, Mass. *Helminths*.
1266. Prof. ALEXANDER WINCHELL (Professor of Natural History, University of Michigan), Ann Arbor, Mich. *Helminths*.

MOLLUSKS.

1267. Prof. LOUIS AGASSIZ (Professor of Zoölogy and Geology, Harvard University; Curator and Director, Museum of Comparative Zoölogy), Cambridge, Mass. *General*.
1268. TRUMAN H. ALDRICH, Troy, N. Y. *Local*.
1269. ANSON ALLEN, Orono, Me. *Terrestrial and Fluvial*.
1270. J. G. ANTHONY (Assistant, Museum of Comparative Zoölogy), Cambridge, Mass. *General*. *Special, North American Terrestrial and Fluvial*.
1271. RAFAEL ARANGO, Habana, Cuba. *Cuban*.
1272. J. W. ARNOLD (Cabinet Keeper and Curator of Mollusca, Worcester Society of Natural History), Worcester, Mass. *Local*.
1273. E. P. AUSTIN, Cambridge, Mass. *Local Terrestrial and Fluvial*.
1274. Rev. JOSEPH BANYARD, Patterson, N. J. *Local*.
1275. Rev. E. R. BEADLE (Secretary, Conchological Section, Academy of Natural Sciences, Philadelphia, Pa. *General*.
1276. A. S. BICKMORE, New York, N. Y.), *General*.
1277. B. BILLINGS, Ottawa City, Canada West. *Local*.
1278. E. BILLINGS (Palæontologist, Geological Survey of Canada), Montreal, Canada. *Fossil*.
1279. WILLIAM G. BINNEY, Burlington, N. J. *North American Terrestrial*.
1280. THOMAS BLAND, Brooklyn, N. Y., or No. 42 Pine street, New York, N. Y. *North American and West Indian Terrestrial*.
1281. Rev. E. C. BOLLES (Corresponding Secretary, Portland Society of Natural History), Portland, Me. *North American Terrestrial and Fluvial*.
1282. A. D. BROWN, Princeton, N. J. *Terrestrial*.
1283. ROBERT H. BROWNNE (Recording Secretary, Lyceum of Natural History of New York), No. 54 West Fifteenth street, New York City; No. 91 South Ninth street, Williamsburgh, N. Y. *General*.
1284. Dr. P. P. CARPENTER, Montreal, Canada. *General*. *Special, Pacific Coast of North America*.
1285. RICARDO I. CAY, Matanzas, Cuba. *Cuban*.

1286. L. E. CHITTENDEN, No. 252 Broadway, New York, N. Y. *Local*.
1287. DR. DANIEL CLARKE (President, Flint Scientific Institute), Flint, Mich. *Local*.
1288. Prof. H. JAMES-CLARK (Professor of Natural History, Pennsylvania Agricultural College), Centre Co., Pa. *Anatomy*.
1289. WILLIAM C. CLEVELAND, No. 46 Washington street, Boston, Mass. *North American Terrestrial and Fluvialile*.
1290. T. A. CONRAD, Academy of Natural Sciences, Philadelphia, Pa. *Natades and Fossil*.
1291. CALEB COOKE (Curator of Articulata, Essex Institute), Salem, Mass. *Local*.
1292. DR. FRANCISCO J. CORONADO, Habana, Cuba. *Cuban*.
1293. A. O. CURRIER, Grand Rapids, Mich. *North American*.
1294. WILLIAM H. DALL, Academy of Natural Sciences, Chicago, Ill. *North American. Special, Pacific Slope*.
1295. HENRY DAVIS, McGregor, Iowa. *Local*.
1296. DR. J. W. DAWSON (Principal, McGill University), Montreal, Canada. *Fossil*.
1297. DR. WM. H. DE CAMP, Grand Rapids, Mich. *North American*.
1298. A. DIETZ, St. Thomas, West Indies. *General. Special, West Indian*.
1299. G. W. DUNN, San Francisco, Cal. *General*.
1300. DAVID W. FERGUSON, Brooklyn, N. Y. *Local*.
1301. DR. A. E. FOOTE, Ann Arbor, Mich. *North American Terrestrial and Fluvialile*.
1302. JONATHAN FORD, Philadelphia, Pa. *Marine Gasteropods*.
1303. DR. E. FOREMAN, Catonsville, Md. *General*.
1304. R. J. FOWLER, Montreal, Canada. *Local*.
1305. C. B. FULLER, Portland, Me. *Local*.
1306. ANDREW GARRETT, Care of Samuel Hubbard, San Francisco, Cal. *South Seas*.
1307. Prof. THEODORE GILL (Librarian, Smithsonian Institution), Washington, D. C. *General*.
1308. THOMAS A. GREENE, New Bedford, Mass. *General*.
1309. H. HAAGENSEN, St. Thomas, West Indies. *West Indian*.
1310. WILLIAM A. HAINES, No. 177 Madison Avenue, New York, N. Y. *General*.
1311. Prof. S. S. HALDEMAN, Columbia, Pa. *North American Fluvialile*.
1312. Mrs. I. D. HALL, New Bedford, Mass. *Local*.
1313. Prof. JAMES HALL (Curator, State Geological Museum, State Geologist of New York), Albany, N. Y. *Fossil*.
1314. DR. W. H. HARTMAN, Westchester, Chester Co., Pa. *Local*.
1315. M. W. HARRINGTON (Assistant, Museum of the University of

- Michigan), Ann Arbor, Mich. *North American Terrestrial and Fluvialite*.
1316. C. FRED. HARTT, Cooper Institute, New York, N. Y. *Brachio-pods, Living and Fossil*.
1317. J. P. HASKELL, Marblehead, Mass. *Local*.
1318. THOMAS C. HASKELL, Swampscott, Mass. *Local*.
1319. Prof. F. V. HAYDEN (Professor of Geology and Mineralogy, University of Pennsylvania), Philadelphia, Pa. *North American Fossil*.
1320. Prof. F. S. HOLMES, Charleston, S. C. *Southern States, Living and Fossil*.
1321. ROBERT HOWELL, Nichols, Tioga Co., N. Y. *Local*.
1322. Dr. S. B. HOWELL (Chairman, Committee on Cephalopoda, Conchological Section, Academy of Natural Sciences), Philadelphia, Pa. *Cephalopods*.
1323. Dr. P. R. HOY, Racine, Wis. *Local*.
1324. Dr. E. W. HUBBARD, Tottenville, Staten Island, N. Y. *General*.
1325. ALPHEUS HYATT (Curator of Palæontology, Boston Society of Natural History; Curator of Polyzoa and Palæontology, Essex Institute; Editor, American Naturalist), Salem, Mass. *Cephalopods and Polyzoa, Living and Fossil*.
1326. J. W. JACKMAN, Newburyport, Mass. *Local*.
1327. U. P. JAMES, Cincinnati, Ohio. *North American*.
1328. Dr. JNO. C. JAY, Rye, Westchester Co., N. Y. *General*.
1329. Col. EZEKIEL JEWETT, Utica, N. Y. *Fossil, and a Collector*.
1330. FRANCISCO DE JIMENO, Matanzas, Cuba. *Cuban*.
1331. Prof. SAMUEL JONES (Professor of Natural Science, Jefferson College), Canonsburg, Washington Co., N. Y. *Local*.
1332. Rev. P. P. KIDDER, Ellcottsville, N. Y. *Local*.
1333. Capt. H. F. KING (Curator of Mollusca, Essex Institute), Salem, Mass. *General Collection*.
1334. Rev. A. B. KENDIG, Davenport, Iowa. *North American Fluvialite and Terrestrial Gasteropods*.
1335. Dr. J. P. KIRTLAND, East Rockport, Ohio; Post-office address, Cleveland, Ohio. *Local*.
1336. HENRY KREBS, St. Thomas, West Indies. *West Indian*.
1337. Dr. I. A. LAPHAM (President, Wisconsin Historical Society), Milwaukee, Wis. *Local*.
1338. Dr. GEORGE A. LATHROP, East Saganaw, Mich. *Local*.
1339. ISAAC LEA (Vice President, American Philosophical Society; Director, Conchological Section, Academy of Natural Sciences), No. 1622 Locust street, Philadelphia, Pa. *Fluvialite, Terrestrial, and Fossil*.

1340. DR. JAMES LEWIS, Mohawk, N. Y. *Local*.
1341. REV. SAMUEL LOCKWOOD, Keyport, N. J. *Local*.
1342. A. B. LYON, Ann Arbor, Mich. *Terrestrial and Fluvatile*.
1343. W. L. MACTIER (Treasurer, Conchological Section, Academy of Natural Sciences), No. 132 Walnut street, Philadelphia, Pa. *General*.
1344. WILLIAM T. MARCH, Spanishtown, Jamaica. *West Indian*.
1345. PROF. R. Z. MASON, Appleton, Wis. *Local*.
1346. E. R. MAYO, No. 82 Milk street, Boston, Mass.
1347. F. B. MEEK, Smithsonian Institution, Washington, D. C. *Fossil*.
1348. DR. MANLY MILES (Professor of Animal Physiology and Practical Agriculture, State Agricultural College), Lansing, Mich. *Local*.
1349. HENRY MOORES, Columbus, Ohio. *Local*.
1350. EDWARD S. MORSE (Curator of Mollusca, Boston Society of Natural History; Curator of Mollusca, Essex Institute; Editor, American Naturalist), Salem, Mass. *General*. *Special*, *North American Fluvatile and Terrestrial*.
1351. DR. WESLEY NEWCOMB, San Francisco, Cal. *General*. *Special*, *Pacific Slope of America*. *Achatinellæ*.
1352. DR. EDWARD J. NOLAND (Conservator, Conchological Section, Academy of Natural Sciences), Philadelphia, Pa. *General*.
1353. CHARLES F. PARKER (Librarian, Conchological Section, Academy of Natural Sciences), Philadelphia, Pa. *General*.
1354. GEORGE H. PERKINS, Galesburg, Ill. *North American*.
1355. JNO. S. PHILLIPS, Philadelphia, Pa. *Marine Acephala*.
1356. PROF. J. W. POWELL, Normal, Ill. *Fluvatile and Fossil*.
1357. MANUEL J. PRESAS, Calle de Velarde, No. 5, Matanzas, Cuba. *Cuban*.
1358. TEMPLE PRIME, No. 26 Broad street, New York, N. Y. *Corbiculadæ*.
1359. DR. EDMUND RAVENEL, Charleston, S. C. *Local and Fossil*.
1360. J. R. READ, New Bedford, Mass. *Local*.
1361. J. H. REDFIELD, Philadelphia, Pa. *Local*.
1362. A. B. RICHMOND, Meadsville, Pa. *Local*.
1363. A. H. RIISE, St. Thomas, West Indies. *West Indian*.
1364. T. RIMMER, Montreal, Canada. *General*.
1365. S. R. ROBERTS (Recorder, Conchological Section, Academy of Natural Sciences), Philadelphia, Pa. *General*.
1366. C. T. ROBINSON (Curator of Mollusca, Buffalo Society of Natural Science), No. 31 Wall street, New York, N. Y. *General*.
1367. HENRY ROUSSEAU, Troy, N. Y. *Fossil*. *Local*.
1368. REV. J. ROWELL, San Francisco, Cal. *Local*.
1369. DR. W. S. W. RUSCHENBERGER, Philadelphia, Pa. *General*.

1370. Prof. ABRAM SAGER (Professor of Obstetrics, University of Michigan), Ann Arbor, Mich. *Local*.
1371. JAMES SAMPSON, New Harmony, Ind. *Local*.
1372. GEORGE SCARBOROUGH, Sumner, Atchinson Co., Kansas. *Local*.
1373. N. S. SHALER (Assistant, Museum of Comparative Zoölogy), Cambridge, Mass. *Brachiopods, Living and Fossil*.
1374. Prof. D. S. SHELDON (Professor of Chemistry and Natural Sciences, Griswold College), Davenport, Iowa. *Terrestrial and Fluvatile*.
1375. Dr. E. R. SHOWALTER, Uniontown, Ala. *Local*.
1376. SANDERSON SMITH, No. 26 Broad street, New York, N. Y. *Local*.
1377. ROBERT E. C. STEARNS (Vice President and Curator of Mollusca, California Academy of Sciences), Lock box 1449, Post-office, San Francisco, Cal. *General. Special, Pacific Slope of America*.
1378. J. B. STEERE (Assistant, Museum of the University of Michigan), Ann Arbor, Mich. *North American Terrestrial and Fluvatile*.
1379. D. JACKSON STEWARD, No. 148 Fifth Avenue, New York, N. Y. *General*.
1380. WM. W. STEWART (Custodian, Buffalo Society of Natural Sciences), Buffalo, N. Y. *Local*.
1381. Dr. WILLIAM STIMPSON (Secretary and Director, Chicago Academy of Sciences), Chicago, Ill. *General. Special, Atlantic coast of North America*.
1382. FRANK W. STOWELL, No. 191 Fulton avenue, Brooklyn, N. Y. *American*.
1383. RICHARD H. STRETCH, Virginia City, Nevada. *Local*.
1384. ROBERT L. STUART, No. 154 Fifth avenue, New York, N. Y. *General*.
1385. JOSEPH SULLIVANT, Columbus, Ohio. *Local*.
1386. ROBERT SWIFT, St. Thomas, West Indies, or care of Thomas Bland, 42 Pine street, New York, N. Y. *General. Special, West Indian*.
1387. Dr. THEODORE A. TELLKAMPF, No. 142 West Fourth street, New York, N. Y. *Ascidians*.
1388. L. L. THAXTER, No. 13 Tremont street, Boston, Mass. *New England Terrestrial and Fluvatile*.
1389. JOHN H. THOMSON, New Bedford, Mass. *Terrestrial and Fluvatile Gasteropods*.
1390. Dr. J. B. TRASK, San Francisco, Cal. *Californian*.
1391. Dr. J. B. TREMBLEY, Toledo, Ohio. *Local*.
1392. GEORGE W. TRYON, jr. (Vice Director, Conchological Section, Academy of Natural Sciences; Editor, American Journal of Conchology), No. 625 Market st., Philadelphia, Pa. *General*.
- NATURALISTS' DIRECTORY. 8 June, 1868.

1393. J. C. TURNPENNY, Philadelphia, Pa. *Marine Acephala*.
1394. HENRY D. VAN NOSTRAND, No. 116 West street, New York, N. Y. *General*.
1395. Prof. A. E. VERRILL (Professor of Zoölogy, Yale College; Curator of Radiates, Boston Society of Natural History), New Haven, Ct. *American*.
1396. Rev. Mr. VILLENEUVE, Montreal, Canada. *Local*.
1397. W. E. WELLINGTON, Dubuque, Iowa. *Local*.
1398. CHARLES M. WHEATLEY, Phoenixville, Pa., or 42 Pine street, New York, N. Y. *Fluviatile*.
1399. JOHN M. WHEATON, Columbus, Ohio. *Local*.
1400. J. F. WHITEAVES (Recording Secretary and Curator, Natural History Society of Montreal), Montreal, Canada. *General*.
1401. HENRY S. WILLIAMS, Ithaca, N. Y. *Local, Living and Fossil*.
1402. J. R. WILLIS, Halifax, Nova Scotia. *Local*.
1403. Prof. ALEX. WINCHELL (Professor of Natural History, University of Michigan), Ann Arbor, Mich. *Terrestrial and Fluviatile*.
1404. A. YOUNG, Brooklyn, N. Y. *General*.

RADIATES.

1405. A. E. R. AGASSIZ (Assistant, Museum of Comparative Zoölogy), Cambridge, Mass. *General. Special, Echinoderms and Acelephs*.
1406. Prof. LOUIS AGASSIZ (Professor of Geology and Zoölogy, Harvard University; Curator and Director, Museum of Comparative Zoölogy), Cambridge, Mass. *General*.
1407. Rev. WILLIAM H. BARRIS, Burlington, Iowa. *Fossil Crinoids*.
1408. Prof. H. JAMES-CLARK (Professor of Natural History, Pennsylvania Agricultural College), Centre Co., Pa. *Anatomy*.
1409. Prof. JAMES D. DANA (Professor of Geology and Mineralogy, Yale College), New Haven, Ct. *Polyps*.
1410. P. DUCHASSAING, St. Thomas, West Indies. *Polyps*.
1411. CHARLES B. FULLER, Portland, Me. *New England*.
1412. B. J. HALL, Burlington, Iowa. *Fossil Crinoids*.
1413. Prof. C. FRED. HARTT (Professor of Natural History, Vassar College), Poughkeepsie, N. Y. *Polyps*.
1414. JOHN G. HEYWOOD (Assistant Curator of Radiata, Worcester Society of Natural History), Worcester, Mass.
1415. Dr. J. B. HOLDER, U. S. Army. *Florida Corals*.
1416. Col. THEODORE LYMAN (Assistant, Museum of Comparative Zoölogy), Brookline, Mass. *Ophiurans and Polyps*.

1417. Prof. JOHN MCCRADY, Charleston, S. C. *Living and Fossil.*
1418. F. B. MEEK, Smithsonian Institution, Washington, D. C. *Fossil.*
1419. W. H. NILES, Cambridge, Mass. *Crinoids, Living and Fossil.*
1420. Dr. WILLIAM STIMPSON (Secretary, and Director of the Museum, Chicago Academy of Sciences), Chicago, Ill. *Echinoderms and Polyps.*
1421. Dr. O. THEIME, Burlington, Iowa. *Fossil Crinoids.*
1422. Prof. A. E. VERRILL (Professor of Zoölogy, Yale College; Curator of Radiates, Boston Society of Natural History), New Haven, Ct. *General. Special, Polyps and Echinoderms.*
1423. Dr. CHARLES A. WHITE (State Geologist of Iowa), Iowa City, Iowa. *Fossil.*

PROTOZOA.

1424. Prof. H. JAMES-CLARK (Professor of Natural History, Pennsylvania Agricultural College), Centre Co., Pa. *General.*
1425. P. DUCHASSAING, St. Thomas, West Indies. *Sponges.*
1426. ALPHEUS HYATT (Curator of Palæontology, Boston Society of Natural History; Curator in Natural History Department, Essex Institute; Editor, American Naturalist), Salem, Mass. *General.*
1427. Prof. O. C. MARSH (Professor of Palæontology, Yale College), New Haven, Ct. *Fossil Sponges.*
1428. Prof. ALEXANDER WINCHELL (Professor of Natural History, University of Michigan), Ann Arbor, Mich. *Local.*

PARASITES.

1429. Prof. H. JAMES-CLARK (Professor of Natural History, Pennsylvania Agricultural College), Centre Co., Pa. *Vegetable.*
1430. Prof. JOSEPH LEIDY (Professor of Anatomy, University of Pennsylvania; Curator, Academy of Natural Sciences of Philadelphia), No. 1302 Filbert street, Philadelphia, Pa. *General.*
1431. Prof. J. H. SALISBURY (Professor of Physiology, Histology, and Cell Pathology, Charity Hospital Medical College), Cleveland, Ohio. *General.*
1432. Dr. F. R. STURGIS, No. 103 Ninth street, New York, N. Y. *Human.*
1433. Prof. J. C. WHITE (Adjunct Professor of Chemistry and Lecturer on Diseases of the Skin), Boston, Mass. *Human.*
1434. Prof. JEFFRIES WYMAN (Professor of Anatomy and Physiology, Harvard University; President, Boston Society of Natural History), Cambridge, Mass. *General.*

ADDITIONAL NAMES RECEIVED.

GEOLOGY.

1435. WILLIAM ANDREWS, Cumberland, Md. *Local*.
1436. DR. GEO. S. BLAKIE, Nashville, Tenn. *Local*.
1437. W. T. BRIGHAM (Curator of Geology, Boston Society of Natural History), Boston, Mass. *General Collection*. *Special*, *Volcanic*.
1438. DR. A. E. FOOTE (Assistant in Mineralogy, University of Michigan), Ann Arbor, Mich. *General Collection*.
1439. Prof. C. FRED. HARTT (Professor of Natural History, Vassar College), Poughkeepsie, N. Y. *North and South American*.
1440. Prof. HENRY Y. HIND (Professor of Physical and Natural Sciences, Trinity College), Toronto, C. W. *British American*.
1441. JAMES HYATT, Bengall, N. Y. *Local*.
1442. Prof. CHARLES A. JOY, Columbia College, New York, N. Y. *North American*.
1443. Prof. JOSEPH LE CONTE (Professor of Chemistry and Mineralogy, University of South Carolina), Columbia, S. C. *North American*.
1444. DR. GEORGE LITTLE (State Geologist of Mississippi), Oxford, Miss. *North American*.
1445. THOMAS MCFARLANE, Acton Vale, Canada East. *Local*.
1446. Rev. JOHN B. PERRY (Assistant, Museum of Comparative Zoölogy), Cambridge, Mass. *North American*.
1447. GEORGE L. VOSE, Paris Hill, Me. *General*.
1448. HENRY S. WILLIAMS, Ithaca, N. Y. *Local*.

PHYSICAL GEOGRAPHY.

1449. A. S. BICKMORE, Amherst, Mass. *Asia*.
1450. Prof. JAMES ORTON, Rochester, N. Y. *Andes and Amazons*.

MINERALS,

1451. EDWARD S. F. ARNOLD, Yonkers, Westchester Co., N. Y.
1452. DR. GEO. S. BLAKIE, Nashville, Tenn.
1453. DR. WM. H. DE CAMP, Grand Rapids, Mich.
1454. Prof. SILAS H. DOUGLASS (Professor of Chemistry and Mineralogy, University of Michigan), Ann Arbor, Mich.

1455. Dr. A. E. FOOTE (Assistant in Mineralogy, University of Michigan), Ann Arbor, Mich.
1456. A. P. GARBER, Columbia, Lancaster Co., Pa.
1457. LEVI HAGER, West Hartford, Vt.
1458. Prof. EUGENE W. HILGARD (Professor of Chemistry and Mineralogy, University of Mississippi), Oxford, Miss.
1459. C. C. HITCHCOCK, Ware, Mass.
1460. Prof. EDMUND O. HOVEY (Professor of Chemistry and Geology, Wabash College), Crawfordsville, Ind.
1461. Prof. CHARLES A. JOY, Columbia College, New York, N. Y.
1462. J. B. KEVINSKI, Lancaster, Pa.
1463. Prof. JOSEPH LE CONTE (Professor of Chemistry and Mineralogy, University of South Carolina), Columbia, S. C. *N. American.*
1464. THOMAS MCFARLANE, Acton Vale, Canada East.
1465. Prof. A. E. STRONG, Grand Rapids, Mich.
1466. Prof. G. C. SWALLOW (State Geologist of Missouri and Kansas), Columbia, Boone Co., Mo.
1467. HENRY S. WILLIAMS, Ithaca, N. Y.

METALLURGY.

1468. Prof. HENRY S. OSBORN (Professor of Mining and Metallurgy, Lafayette College), Easton, Pa.
1469. Dr. ALBERT B. PRESCOTT (Assistant Professor of Chemistry, etc., University of Michigan), Ann Arbor, Mich.

PALEONTOLOGY.

1470. WILLIAM ANDREWS, Cumberland, Md. *Local.*
1471. HENRY DAVIS, McGregor, Iowa. *Local. Collector and Dealer.*
1472. W. H. R. LYKINS, Kansas City, Mo. *Local.*
1473. Prof. JOHN MCCRADY, Charleston, S. C. *Southern States. Special, Echinoderms and Graptolites.*
1474. EDWARD T. NELSON, New Haven, Ct. *North American.*
1475. G. H. PERKINS, New Haven, Ct. *North American.*
1476. HENRY S. WILLIAMS, Ithaca, N. Y. *Local.*

ANATOMY AND PHYSIOLOGY.

1477. Prof. CORYDON L. FORD (Professor of Anatomy and Physiology, University of Michigan), Ann Arbor, Mich.
1478. Prof. JOHN LEAMAN (Professor of Human Physiology and Anatomy, Lafayette College), Easton, Pa.

MICROSCOPY.

1479. Dr. GEO. S. BLAKIE, Nashville, Tenn.
1480. W. H. COBB, Wellsborough, Tioga Co., Pa.
1481. HIRAM A. CUTTING, Lunenburg, Essex Co., Vt.
1482. Dr. J. BAKER EDWARDS, Montreal, Canada.
1483. A. S. RITCHIE, Montreal, Canada.
1484. GEORGE B. SELDEN, Rochester, N. Y.
1485. C. A. SPENCER, Canastota, N. Y.

BOTANY.

1486. Dr. GEO. S. BLAKIE, Nashville, Tenn. *Local.*
1487. J. J. CARTER, Lyle, Lancaster Co., Pa. *Local.*
1488. A. P. GARBER, Columbia, Lancaster Co., Pa. *Local.*
1489. BENJ. D. GILBERT, Utica, N. Y. *Local.*
1490. E. L. HANKENSON, Newark, N. Y. *Local.*
1491. M. W. HARRINGTON (Assistant in the Museum, University of Michigan), Ann Arbor, Mich. *Local.*
1492. JAMES HYATT, Bengall, N. Y. *Local.*
1493. A. B. LYON (Assistant in the Museum, University of Michigan), Ann Arbor, Mich. *Local.*
1494. D. R. MCCORD, Montreal, Canada. *Canadian Ferns.*
1495. L. A. MILLINGTON, Glens Falls, N. Y. *Local.*
1496. Dr. I. S. MOYER, Plumsteadville, Pa. *Local.*
1497. C. S. OSBORNE (Manager, Western Union Telegraph), Suspension Bridge, Niagara Co., N. Y. *Local.*
1498. S. B. PARSONS, Flushing, N. Y. *Local.*
1499. Dr. FRANK SAWERMAN, Apalachicola, Fla. *North American.*
1500. Prof. G. C. SWALLOW (State Geologist of Missouri and Kansas), Columbia, Boone Co., Mo. *Western States.*
1501. Prof. ALEXANDER WINCHELL (Professor of Natural History, University of Michigan), Ann Arbor, Mich. *United States.*

ARCHÆOLOGY.

1502. SAMUEL R. CARTER, Paris Hill, Oxford Co., Me. *North American.*
1503. HENRY DAVIS, McGregor, Iowa. *Local. Collector and Dealer.*
1504. Dr. WILLIAM H. DE CAMP, Grand Rapids, Mich. *Local.*
1505. C. B. FULLER, Portland, Me. *Local.*
1506. Hon. E. L. HAMLIN (President, Bangor Historical Society), Bangor, Me. *North American.*
1507. Prof. EDWARD HITCHCOCK (Professor of Hygiene and Physical Education, Amherst College), Amherst, Mass. *N. American.*
1508. Rev. N. W. JONES, New York, N. Y. *North American.*
1509. E. S. MORSE (Curator of Mollusks, Boston Society of Natural History; Curator in Natural History Department Essex Institute) Salem, Mass. *New England.*
1510. F. W. PUTNAM (Curator of Fishes, Boston Society of Natural History; Superintendent, Museum of the Essex Institute), Salem, Mass. *New England.*

ETHNOLOGY.

1511. A. S. BICKMORE, Amherst, Mass. *Asia.*

MAMMALS.

1512. G. W. ADERHOLD, A. and M. College, Lexington, Ky. *Local. Taxidermist.*

BIRDS.

1513. G. W. ADERHOLD, A. and M. College, Lexington, Ky. *Local. Taxidermist.*
1514. ANSON ALLEN, Orono, Me. *Local.*
1515. E. A. JOHNSON, Holyoke, Mass. *Local.*
1516. B. F. OWEN, Astoria, Fulton Co., Ill. *Local.*

FISHES.

1517. Dr. JAMES BLAKE, San Francisco, Cal. *Embiotocoids.*
1518. Dr. J. C. PARKER, Grand Rapids, Mich. *Local.*

INSECTS.

1519. EDWARD P. ALLIS, jr., Yellow Springs, Ohio. *Local*.
1520. Prof. ALBERT J. COOK (Professor of Natural History, State Agricultural College), Lansing, Mich. *General Collection*.
1521. E. A. JOHNSON, Holyoke, Mass. *Local*.
1522. T. F. MCCURDY, Norwich Town, Ct. *Local*.
1523. Dr. ALEX. F. SAMUELS, Nashotah, Waukesha Co., Wis. *Lepidoptera*.
1524. G. WICKWIRE SMITH (Corresponding Secretary, Kent Scientific Institute), Grand Rapids, Mich. *Local*.
1525. Dr. G. S. WALKER, No. 1226 Washington avenue, St. Louis, Mo. *Local*.

MOLLUSKS.

1526. Col. F. F. CAVADA, Trinidad, W. I. *West Indian*.
1527. Hon. EDWARD CHITTY, Kingston, Jamaica. *West Indian*.
1528. Dr. J. G. COOPER (Zoölogist, California State Geological Survey), San Francisco, Cal. *Pacific Slope of America*.
1529. W. M. GABB (Palæontologist, California State Geological Survey), San Francisco, Cal. *Fossil*.
1530. W. G. W. HARFORD, San Francisco, Cal. *General*.
1531. Dr. JOHN C. JAY, Mamaroneck, N. Y. *Local*.
1532. GEORGE METZGES, Circleville, Ohio. *Local*.
1533. JOHN A. MCNIEL, Grand Rapids, Mich. *General Collector. Special, Fresh Water*. (Now collecting in Central America. Address care of Peabody Academy of Science, Salem, Mass.)
1534. EDWARD T. NELSON, New Haven, Ct. *Local*.
1535. Dr. R. A. PHILLIPPI, Santiago, Chili. *Chilian*.
1536. Prof. FELIPE POEY, Habana, Cuba. *Cuban*.
1537. HENRY STRENG, Holland, Mich. *Fresh Water. Local*.

TAXIDERMISTS.

1538. G. W. ADERHOLD, A. & M. College, Lexington, Ky.
 1539. JOHN AKHURST, No. 9½ Prospect street, Brooklyn, N. Y.
 1540. A. L. BABCOCK, Sherborn, Mass.
 1541. J. P. BATES, No. 209½ North Sixth street, St. Louis, Mo.
 1542. JOHN G. BELL, No. 339 Broadway, New York, N. Y.
 1543. C. L. BLOOD, Corner of Weir and First streets, Taunton, Mass.
 1544. Mrs. J. L. BODE, No. 16 North William street, New York, N. Y.
 1544a. RUDOLPH BORCHERT, Chicago, Ill.
 1545. C. G. BREWSTER, No. 16 Tremont street, Boston, Mass.
 1546. GEORGE E. BROWN, Dedham, Mass.
 1547. JOSEPH BRUNO, Philadelphia, Pa.
 1548. DE SCHUTE BUCKOW, No. 27 Frankfort street, New York, N. Y.
General Collector of South American Animals and Plants.
 1549. WILLIAM COUPER, Henderson's Buildings, Louis street, Quebec, Canada.
 1550. C. A. CRAIG, Montreal, Canada.
 1551. J. C. DEACON, Chicopee, Mass.
 1552. T. W. DEWING, Saxonville, Mass.
 1553. C. DREXLER, Washington, D. C.
 1554. CHARLES FELDMAN, Philadelphia, Pa.
 1555. ALEXANDER GALBRAITH, No. 209 North Ninth street, Philadelphia, Pa.
 1556. CHARLES GALBRAITH, West Hoboken, N. J.
 1557. WILLIAM GALBRAITH, West Hoboken, N. J.
 1558. FERDINAND GRUBER, San Francisco, Cal.
 1559. GEORGE HENZEL, Lancaster, Pa.
 1560. CHARLES A. HOUGHTON, Holliston, Mass.
 1561. W. HUNTER, Museum of the Natural History Society, Montreal, Canada.
 1562. ILGES & SAUTER, No. 15 Frankfort street, New York, N. Y.
 1563. JOHN JENKINS, Monroe, Orange Co., N. Y.
 1564. SAMUEL JILLSON, Hudson, Mass.
 1565. JOHN KRIDER, Corner of Second and Walnut streets, Philadelphia, Pa.
 1566. E. V. LORQUIN, San Francisco, Cal.
 1567. C. J. MAYNARD, Newtonville, Mass.
 1568. GEORGE Y. NICKERSON, No. 42 Williams st., New Bedford, Mass.
 1569. G. ORENSHAW, No. 527 North Fifteenth street, Philadelphia, Pa.
 1570. JAMES H. ROOME, No. 55 Carmine street, New York, N. Y.
 1571. S. H. SYLVESTER, Middleborough, Mass.
 1572. JAMES TAYLOR, Philadelphia, Pa.
 1573. N. VICKARY, No. 262 Chestnut street, Lynn, Mass.

1574. GEORGE O. WELCH, Washington street, Lynn, Mass.

1575. ALEXANDER WOLLE, Baltimore, Md.

1576. C. J. WOOD, Philadelphia, Pa.

MINERALOGY.

1577. J. ROSS BROWNE, San Francisco, Cal.

1578. W. S. KEYS, San Francisco, Cal.

COMPARATIVE ANATOMY.

1579. DR. E. L. LATHROP, Room No. 2 Newberry's Block, Chicago, Ill.

BOTANY.

1580. JOHN BUTTLE, San Jose, Cal. *Local.*

1581. W. C. CORMACK, New Westminster, British Columbia. *Local.*
Special, Coniferae.

1582. LLOYD JONES, Victoria, British Columbia. *Local. Special,*
Ferns.

MAMMALS.

1583. HON. JOHN D. CATON, Ottawa, Ill. *American Cervidae.*

BIRDS.

1584. EUGENE V. LORQUIN, San Francisco, Cal. *Local. Taxidermist.*

1585. GEORGE O. WELCH, Washington street, Lynn, Mass. *Local.*
Taxidermist.

INSECTS.

1586. DR. — JONES, New Westminster, British Columbia. *Local.*
Special, Lepidoptera.

MOLLUSKS.

1587. ANDREW J. BENNETT, Circleville, Ohio. *Local.*

ARCHAEOLOGY.

1588. REV. JOSEPH ANDERSON, Waterbury, Ct.

1589. J. J. H. GREGORY, Marblehead, Mass. *North American.*

MICROSCOPY.

1590. S. A. BRIGGS, Chicago, Ill.

FISHES.

1591. DR. J. H. SLACK, Troutdale, Bloomsbury, N. J. *Pisciculture.*

CORRECTIONS.

GEOLOGY.

- 13. FRANK H. BRADLEY. *Change address to* (Assistant, Illinois State Geological Survey), Wilmington, Ill.
- 23. E. T. COX. *Change "Local" to North American.*
- 30. Rev. E. B. EDDY. *Change address to* Providence, R. I.
- 32. *Should be* L. Engelbrecht.
- 35. C. F. ESCHWEILER. *Change address to* Houghton, Mich.
- 51. Prof. C. H. HITCHCOCK. *Change address to* (Professor of Geology, Lafayette College; State Geologist of Maine and New Hampshire), No. 33 Wall street, New York, N. Y.
- 63. CLARENCE KING. *Change address to* United States Geologist of the U. S. Geological Expedition of the 40th Parallel.
- 90. Prof. J. S. NEWBERRY. *Change address to* (Professor of Geology, Columbia College), New York, N. Y.
- 107. Prof. JAMES M. SAFFORD. *Change address to* Lebanon, Tenn.
- 117. Prof. S. TENNEY. *Change address to* (Professor of Natural History, Williams College), Williamstown, Mass.
- 126. Prof. J. D. WHITNEY. *Change address to* (Professor of Geology, School of Mining, Harvard University), Cambridge, Mass.

MINERALOGY.

- 143. W. T. BRIGHAM. *Add* (Curator of Geology, Boston Society of Natural History).
- 166. Rev. E. B. EDDY. *Change address to* Providence, R. I.
- 171. CHRISTIAN FEBIYER. *Change to* CHRISTIAN FEBIGER.
- 201. Rev. A. B. KENDIG. *Change address to* Dubuque, Iowa.
- 244. Prof. S. TENNEY. *Change address to* (Professor of Natural History, Williams College), Williamstown, Mass.

METALLURGY.

- 273. Prof. J. D. WHITNEY. *Change address to* (Professor of Geology, School of Mining, Harvard University), Cambridge, Mass.

PALÆONTOLOGY.

- 286. FRANK H. BRADLEY. *Change address to* (Assistant, Illinois State Geological Survey), Wilmington, Ill.
- 305. G. R. GILBERT. *Change to* G. K. GILBERT.
- 312. Prof. E. W. HILGARD. *Cross out* "(State Geologist of Mississippi)."
- 319. ALPHEUS HYATT. *Change address to* (Curator of Palæontology, Boston Society of Natural History; Curator in Natural History Department, Essex Institute), Salem, Mass.

PHYSICAL GEOGRAPHY.

1449. A. S. BICKMORE. *Change address to* Tenant's Harbor, Me.
 399. CLARENCE KING. *Change address to* United States Geologist of the U. S. Geological Expedition of the 40th Parallel.
 419. Prof. J. D. WHITNEY. *Change address to* (Professor of Geology, School of Mining, Harvard University), Cambridge, Mass.

COMPARATIVE ANATOMY AND PHYSIOLOGY.

441. Dr. B. G. WILDER. *Change address to* (Professor of Natural History, Cornell University), Ithaca, N. Y.

MICROSCOPY.

484. ALPHEUS HYATT. *Change "Curator of Mollusca" to* Curator of Palæontology.
 461. *Should be* EDWIN BICKNELL.

BOTANY.

512. E. P. AUSTIN. *Change address to* Cambridge, Mass.
 517. Dr. JACOB BARRATT. *Change address to* Middletown, Ct.
 540. *Should be* J. BUCHANAN.
 550. Prof. P. A. CHADBOURNE. *Change address to* (President, Wisconsin State University), Madison, Wis.
 553. *Should be* Dr. A. CLAPP.
 574. *Change to* Dr. ELIAS DIFFENBAUGH, No. 1113 Carlton street, Philadelphia, Pa.
 652. JOHN MACOUN. *Add, Special, Carices.*
 674. CHARLES F. PARKER. *Change to* Camden, N. J. *North American. Special, New Jersey.*
 696. Dr. J. T. ROTHROCK. *Change address to* (Professor of Botany, Pennsylvania State Agricultural College), Centre Co., Pa.
 729. Prof. S. TENNEY. *Change address to* (Professor of Natural History, Williams College), Williamstown, Mass.

ETHNOLOGY.

1511. A. S. BICKMORE. *Change address to* Tenant's Harbor, Me.
 778. Dr. J. C. NOTT. *Change address to* New York, N. Y.

BIRDS.

877. D. DARWIN HUGHES. *Change "Local" to* North American.
 896. Rev. A. B. KENDIG. *Change address to* Dubuque, Iowa.
 903. CHARLES H. NAUMAN. *Change address to* No. 195 East King street, Lancaster, Pa. *Add, Osology.*

911. HENRY A. PURDIE. *Change address to West Newton, Mass., and department to New England.*

REPTILES.

- 966 Dr. B. G. WILDER. *Change address to Ithaca, N. Y.*

FISHES.

977. Dr. WM. O. AYRES. *Cross out* " (Corresponding Secretary, California Academy of Natural Sciences)."
 987. Dr. W. P. GIBBONS. *Change address to Alameda, Cal.*
 1002. Dr. WILLIAM A. NASON. *Change address to Algonquin, McHenry Co., Ill.*
 1013. Dr. B. G. WILDER. *Change address to Ithaca, N. Y.*

INSECTS.

1033. JAMES S. BEHRENS. *Add, General Collection.*
 1048. — BOTTIN. *Change to — BOTTERI.*
 1077. THOMAS A. DICKINSON. *Change address to (Secretary, Androcoggin Natural History Society), Lewiston, Me. Local. Coleoptera and Lepidoptera.*
 1081. WILLIAM H. EDWARDS. *Change address to Coalburgh, Kanawha Co., West Virginia.*
 1108. AUGUSTUS R. GROTE. *Change address to Hastings-upon-Hudson, N. Y., and dep't to General, Special, Lepidoptera.*
 1127. WILLIAM KEOSTLIN. *Change to WILLIAM KESTLING.*
 1151. Dr. WILLIAM A. NASON. *Change address to Algonquin, McHenry Co., Ill.*
 1178. C. V. RILEY. *Change address to (State Entomologist of Missouri), No. 2130 Clark street, St. Louis, Mo. North American. Special, Injurious to Vegetation.*
 1203. PHILIP S. SPRAGUE. *Change address to No. 141 Broadway, South Boston, Mass., and dep't to North American Coleoptera.*
 1204. *Cross out Mrs. PHILIP S. SPRAGUE.*

MOLLUSKS.

1276. A. S. BICKMORE. *Change address to Tenant's Harbor, Me.*
 1289. WILLIAM C. CLEVELAND. *Change address to (Professor of Engineering, Cornell University), Ithaca, N. Y.*
 1334. Rev. A. B. KENDIG. *Change address to Dubuque, Iowa.*
 1532. GEORGE METZGES. *Should be GEORGE METZGER.*
 1351. Dr. WESLEY NEWCOMB. *Change address to Oakland, Cal.*

DECEASED.

97. (Geology.) Prof. E. J. PICKETT, Rochester, N. Y. *Died* October, 1866.
333. (Palæontology.) 998. (Fishes.) Dr. R. P. MANN, Milford, Ohio. *Died* ———.
354. (Palæontology.) AUGUSTE RÉMOND, San Francisco, Cal. *Died* 1867.
376. (Physical Geography.) Prof. A. D. BACHE, Washington, D. C. *Died* 1866.
483. (Microscopy.) WILLIAM W. HUSE, Brooklyn, N. Y. *Died* 1867.
572. (Botany.) W. W. DENSLOW, New York, N. Y. *Died* 1868.
573. (Botany.) Prof. CHESTER DEWEY, Rochester, N. Y. *Died* December, 1867.
604. (Botany.) 1308. (Mollusks.) THOMAS A. GREENE, New Bedford, Mass. *Died* 1868.
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TO THE NATURALISTS' DIRECTORY.

NORTH AMERICA AND THE WEST INDIES.

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While the Index has been going through the press, the following additions and corrections have been received.

ADDITIONS.

ETHNOLOGY.

1592. REV. JOSEPH ANDERSON, Waterbury, Ct. *American Indians.*

MOLLUSKS.

1593. HARRISON E. WEBSTER, Union College, Schenectady, N. Y.
1594. GEORGE Y. NICKERSON, 86 Williams street, New Bedford, Mass.
Dealer.
1595. HENRY FREEDLEY, Norristown, Pa. *General Collection.*

MINERALS.

1596. R. H. STRETCH (State Mineralogist of Nevada), Virginia City, Nevada.

INSECTS.

1597. HENRY EDWARDS, Metropolitan Theatre, San Francisco, Cal.
General Collection.
1598. W. V. ANDREWS, West Hoboken, N. J. *Lepidoptera.*
1599. JOSEPH R. CHURCHILL, Milton Lower Mills, Mass. *New England.*

MAMMALS.

1600. DR. FRANCIS R. STÆHLI, (Assistant, Museum of Comparative Zoölogy), Cambridge, Mass. *General.*

BIRDS.

1601. DR. FRANCIS R. STÆHLI (Assistant, Museum of Comparative Zoölogy), Cambridge, Mass. *General.*
1602. MISS GRACE ANNA LEWIS, Sunnyside, Kimberton, Chester Co., Penn.

TAXIDERMISTS AND DEALERS.

1603. WALLACE AND HOLLINGSWORTH, No. 14 North William street, New York, N. Y.

CORRECTIONS.

- 13, 286. FRANK H. BRADLEY. *Change to* (Professor of Natural Science, Hanover College), Hanover, Ind.
- 840, 982. SAMUEL C. CLARKE, *Change address to* Jamaica Plain, Mass.
- 845, 1070, 1549. WILLIAM COUPER. *Change to* Ottawa City, O., Canada.
- 471, 581. ARTHUR M. EDWARDS. *Change to* (Professor of Inorganic and Organic Chemistry, Woman's Medical College), No. 126 Second avenue, house 49 Jane street, New York, N. Y.
- 861, 1555. Should be ALEXANDER GALBRAITH.
- 310, 1249, 1316, 1418, 1439. C. FRED HARTT. *Change to* (Professor of Geology, Cornell University), Ithaca, N. Y.
- 70, 330, 644. Prof. LEO LESQUEREUX. *Change address to* Museum of Comparative Zoölogy, Cambridge, Mass.
650. Should be Dr. STARLING LORING.
1144. THEODORE L. MEAD. *Change department to* North American and European Lepidoptera.
- 92, 342. W. H. NILES. *Change address to* Cambridge, Mass.
734. Should be NORTON S. TOWNSEND.
1229. Rev. J. WASSALL. *Change address to* Mazo Manie, Wis.
- 967, 1401, 1448, 1467, 1476. HENRY S. WILLIAMS. *Change to* (Assistant in Geology, Yale College), New Haven, Ct.
-

DECEASED.

625. (Botany.) 1120. (Insects.) Rev. JAMES HUBBERT, Richmond, Canada East. *Died* 1868.
-

APPENDIX

TO THE

NATURALISTS' DIRECTORY.

It is proposed to issue several pages of this Appendix with each number of the Proceedings, in order to allow naturalists an early opportunity of stating their wants and what specimens they have for sale or exchange; to give notices of proposed works on Natural History; changes of address of persons whose names have appeared in the Directory; short obituary notices; new names for the Directory; and such other matters as may be of interest and appropriate to the work.

Notices of the change of address or the decease of any person whose name has appeared in the Directory are especially requested, and any person knowing Naturalists whose names have been omitted, will confer a favor by sending the addresses of such to the editor.

Five lines in the "Appendix" are allowed to each subscriber to the Proceedings for notices of specimens and articles for sale. When a notice of more than five lines is inserted 10 cents *per line* will be charged for every additional line. Non subscribers will be charged 10 cents *per line* for any advertisement of specimens for sale.

All notices from subscribers or others, except of specimens or articles for sale, inserted free, at the discretion of the editor.

F. W. PUTNAM,

Editor.

Essex Institute, June 18, 1866.

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AND
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Large collections of named Coleoptera from Brazil, Antilles, Venezuela, New Grenada, and Guyana, for sale. Priced catalogues furnished on application.

WM. COUFER, Quebec, Canada.

Wants to procure the following Coleoptera: *Omus Californicus* Esch., *Amblycheila cylindriciformis* Say, *Cicindela splendida* Hentz, *C. trifasciata* Fabr., *C. obsoleta* Say, *C. pusilla* Say, *C. terricola* Say, *Lachnophorus elegantulus* Mann., *Lebia grandis* Hentz, *L. pulchella* Dej., *Coptodera signata* Dej., *Thalpius pygmaeus* Dej., *Drepanus LeContei* Dej., *Scarites quadriceps* Chaud., *Psimachus punctulatus* Hald., *Cychrus velutinus* Mén., *C. tuberculatus* Harris, *Scaphinotus heros* Harris, *S. elevatus* Fabr., *Sphaeroderus bilobus* Say, *Notiophilus semistriatus* Say, *Badister notatus* Hald., *Dytiscus confusus* Say, *D. Harrisii* Kirby, *Ne-*

crophorus Americanus Oliv., *N. medius* Fabr., *N. marginatus* Fabr., *N. pustulatus* Illig., *Lucanus elaphus* Fabr., *Buprestis sexnotata* Lap., *B. lineata* Fabr., *B. fasciata* Fabr., *B. decora* Fabr., *B. characteristica* Harris. Offers to exchange Northern Coleopterous Insects or North American Birds' Eggs for the above.

WILSON ARMISTEAD, Virginia House, Leeds, England.

This gentleman is engaged upon a work on the Galls and Gall Insects, and requests specimens and observations from all parts of the world.

GEORGE C. BRACKETT, Belfast, Me.

Local Insects for sale.

JOHN AKHURST, 9½ Prospect street, Brooklyn, N. Y.

Coleoptera and Lepidoptera for exchange.

ISAAC A. POOL, 829 Washington street, Chicago, Ill.

Local Insects for exchange.

W. W. CARY, Coleraine, Mass.

Italian Bees for sale.

DR. A. S. PACKARD, Boston Society of Natural History.

Solicits nests containing the larvæ and pupæ of Mud Wasps, Sand Wasps, Paper Wasps; colonies of Humble Bees, Wild Bees, &c. Any information relative to the habits, the mode of making their cells and nests, or to the parasites of the above insects, will be duly accredited. Especial attention is called to the nests or cells of the Solitary Bees which make deep holes in sunny paths and banks; to the Wasps which tunnel the stems of the Dock, Elder, Currant, Raspberry, Blackberry, Syringa, &c.; to those species of *Odynurus*, etc., which construct mud cells in deserted galls and nests of other insects. If desired, specimens received will be returned carefully labelled. The larvæ and pupæ should be preserved in whiskey (high wines) or glycerine, and the perfect insects should be pinned. All the specimens should be carefully labelled with the exact locality, date of collection, and reference to the nest from which they were taken. Dr. Packard's paper on the larvæ and pupæ of the Hymenoptera is to be printed, with figures, in the Proceedings of the Essex Institute.

MOLLUSCA.

WM. HARPER PRASE, Honolulu, Sandwich Islands.

Wants Marine Gasteropods, especially from the East Coast of Africa, Red Sea, East Indies and West Indies. Offers in exchange Land, Fresh-water and Marine Shells of the Pacific Islands.

R. E. C. STERNS, Lock box 1449, San Francisco, Cal.

Pacific coast and Californian Shells for exchange for species from other localities.

DR. GEORGE A. LATHROP, East Saginaw, Mich.

Has Land and Fresh-water Shells of his vicinity for exchange for Shells from other localities, Marine species included.

ANSON ALLEN, Orono, Me.

Local species of Land and Fresh-water Shells for exchange.

GEORGE SCARBOROUGH, Sumner, Atchinson Co., Kansas.

Ohio River Shells for exchange.

REV. A. B. KENDIG, Marshalltown, Marshall Co., Iowa.

Land and Fresh-water Gasteropods for exchange.

CHARLES M. WHEATLEY, Phoenixville, Pa.

Fluviatile Mollusks for exchange.

Wants, either by exchange or purchase, species of Fluviatile Mollusks not in his collection.

REV. JOSEPH BANVARD, Worcester, Mass.

Shells for sale.

ISAAC A. POOL, 829 Washington street, Chicago, Ill.

Western Fresh-water Shells for exchange.

ELIHU HALL, Athens, Menard Co., Ill.

North American Land and Fresh-water Shells for exchange for marine species.

REV. E. C. BOLLES, Portland, Me.

New England Shells for exchange for Land and Fresh-water species from other localities.

JOHN GREGORY, 116 South street, New York, N. Y.

Shells for sale.

GENERAL DEALERS IN SPECIMENS OF NATURAL HISTORY.

C. G. BREWSTER, 16 Tremont street, Boston, Mass.

GEO. Y. NICKERSON, 42 William street, New Bedford, Mass.

JOHN G. BELL, 339 Broadway, New York, N. Y.

———Kaempfer, Madison street, Chicago, Ill.

JAMES EIGHTS, Albany, N. Y.

JOHN AKHURST, 9½ Prospect street, Brooklyn, N. Y.

ILGES AND SANTER, 15 Frankfort street, New York, N. Y.

D. BOURGET, 115 Rua d' Ouvidor, Rio Janeiro, Brazil.

BUFFON & WILSON, 391 Strand, London, W. C., England.

BRYCE M. WRIGHT, 36 Great Russell street, Bloomsbury, London, W. C., England.

ROBERT DAMON, Weymouth, Dorsetshire, England.

B. JACOBS, 68 Leadenhall street, London, England.

JAMES CARFRAE, JR., 79 Princess street, Edinburgh, Scotland.

———BOEHNER, Berlin, Prussia.

A. KOENEN, Berlin, Prussia.

L. W. SCHAUFUSS, Dresden, Saxony.

DEYROLLE ET FILS, 16 Rue de la Monnaie, Paris, France.

EDWARD VERREAUX, Paris, France.

L. PARZUDAKI, Paris, France.

Madame H. DROUET, Paris, France.

ARTHUR ELOFFER, 20 Rue de l'Ecole de Medecine, Paris, France.

JOHN S. STEVENS, Natural History Agency Office, 24 Bloomsbury street, London, W. C., England.

Mr. Stevens is agent for the sale of collections made in various parts of the world, especially from the following places: Europe, Cape of Good Hope, Natal, Gold Coast, Damara Land, Zambesi, Old Calabar, the Gaboon, Madagascar, Bogota, Upper Amazons, Santa Martha, Bahia, Nicaragua, Mexico, Texas, New Guinea, Borneo, Celebes, Sumatra, Java, and other East Indian Islands, Siam, Penang, Cambodia, Laos, Birmah, Himalayan mountains and other parts of India, Ceylon, China, Japan, Philippine Islands, Swan River, South Australia, Victoria, New South Wales, Queensland, North Australia, New Hebrides, Feejee Islands, and New Zealand. Mr. Stevens will send specimens for selection.

DEALERS IN NATURALISTS' APPARATUS.

AMERICAN NET AND TWINE MANUFACTURING Co., 43 Commercial street, Boston, Mass.

Nets and Seines of all description made to order.

CODMAN AND SHURTLEFF, 13 Tremont street, Boston, Mass.

Manufacturers of Forceps, Knives and other Instruments used by Naturalists.

NEW ENGLAND GLASS Co., Boston, Mass.

Glass Jars of all sizes, with glass stoppers, on hand or made to order, for the preservation of alcoholic specimens.

DONNELL & MOORE, Old Cambridge, Mass.

Manufacturers of Tin and Copper Cans for alcoholic specimens

J. L. BODE, 16 North William street, New York, N. Y.

Manufacturer of Birds' eyes.

C. G. REWSTER, 16 Tremont street, Boston, Mass.

Insect Pins.

THEODORE SCHRECKEL, North William street, New York, N. Y.

Has on hand and imports Insect Pins and Entomological Apparatus.

F. W. CHRISTERN, Broadway, New York, N. Y.

Imports Insect Pins.

CHARLES STODDER, 75 Kilby street, Boston, Mass.

Agent for R. B. Tolles, J. Zentmeyer, and W. Wales; Opticians and Makers of Microscopes.

H. M. RAYNOR, 748 Broadway, New York, N. Y.

Platinum Apparatus; Tube, Sheet, Wire, &c., in all forms, for all purposes. Wholesale and Retail.

MICROSCOPE MAKERS.

- W. WALES, Fort Lee, Bergen Co., N. J.
 G. WALE, Bull's Ferry, Bergen Co., N. J.
 J. GRUNOW, New York, N. Y.
 J. ZENTMEYER, Philadelphia, Pa.
 R. B. TOLLES, Canastota, Madison Co., N. Y.
 T. H. McALLISTER, New York, N. Y.

TAXIDERMISTS.

- C. G. BREWSTER, 16 Tremont street, Boston, Mass.
 N. VICKART, 262 Chestnut street, Lynn, Mass.
 A. L. BABCOCK, Sherborn, Mass.
 SAMUEL JILLSON, Hudson (Feltonville), Mass.
 S. H. SYLVESTER, Middleborough, Mass.
 L. J. MAYNARD, Newtonville, Mass.
 J. C. DEACON, Chicopee, Mass.
 C. L. BLOOD, Corner of Weir and First streets, Taunton, Mass.
 GEORGE Y. NICKERSON, 42 Williams street, New Bedford, Mass.
 JOHN JENKINS, Monroe, Orange Co., N. Y.
 JOHN G. BELL, 339 Broadway, New York, N. Y.
 J. L. BODE, 16 North William street, New York, N. Y.
 JOHN AKHURST, 9½ Prospect street, Brooklyn, N. Y.
 JOHN KRIDER, Corner 2d and Walnut streets, Philadelphia, Pa.
 GEORGE HENSEL, Lancaster, Pa.
 C. DREXLER, Washington D. C.
 ALEX. WOLLE, Baltimore, Md.
 WM. COUPER, Henderson's Buildings, Louis street, Quebec, Canada.

LABELS FOR CABINET SPECIMENS.

THE SMITHSONIAN INSTITUTION has printed labels of the Family names of American Birds and Mammals, giving both the Scientific and English names. Also special labels for many Birds, Mammals and other specimens, which it will supply at cost. It will also furnish, at cost, its Check Lists of North American Mammals, Birds, Mollusks, Minerals, Tertiary and Cretaceous Fossils, printed on one side for labelling.

THE ESSEX INSTITUTE is now printing labels for Corals, consisting of the names of the Orders, Suborders, Families and Genera, after the classification of Professor Verrill, which it will furnish at cost.

THE INSTITUTE also proposes to print similar labels for the other classes of Radiates and for the Mollusks and Insects.

PHOTOGRAPHS OF CORALS AND OTHER SPECIMENS.

List of Photographs of Corals, &c., prepared by Prof. A. E. Verrill from original or rare specimens, authentically labeled :—

STEREOSCOPIC PHOTOGRAPHS.

CORALS.

- No. 1. *Astrea speciosa* Dana. Original specimen.
- No. 2. *Astrea* (*Prionastrea*) *robusta* Dana. Original specimen.
- No. 3. *Favia ordinata* Verrill. *Goniastrea aspera* Verrill. *Fungia papillosa* Verrill. Original specimens.
- No. 4. *Calastrea tenuis* Verrill. *Patonia complanata* Verrill. From original specimens.
- No. 5. *Madrepora pumila* Verrill. *M. striata* Verrill, *M. proliza* Verrill. From original specimens.
- No. 6. *Prionastrea Chinensis* Verrill. Original specimen.
- No. 7. *Distichopora nitida* Verrill and *Stylaster elegans* Verrill. From authentic specimens.
- No. 8. *Fungia concinna* Verrill. *F. Haimeri* Verrill. From original specimens.
- No. 9. *Fungia valida* Verrill. Original specimen.
- No. 10. *Allopora Californica* Verrill. Original specimen.
- No. 11. *Madrepora efflorescens* Dana. Original specimen.
- No. 12. *Pocillopora nobilis* Verrill. Authentic specimen.
- No. 13. *Gorgonia Agassizii* Verrill. *G. rigida* Verrill. Authentic specimens.
- No. 14. *Madrepora spicifera* Dana. Original specimen.
- No. 15. *M. convexa* Dana. Authentic specimen.

MISCELLANEOUS.

- No. 16. Four Eggs of *Falco anatum*, from Mt. Tom, Mass.
- No. 17. *Solaster endeca* and *S. papposus*. Eastport, Maine.
- No. 18. *Mastodon* and interior of Prof. J. Wyman's Museum at Cambridge.
- No. 19. Three teeth of *Bison*. Quarternary fossils, Gardiner, Me.
- No. 20. Nine species of Shells from same formation as No. 19.

PLAIN PHOTOGRAPHS, LARGER SIZES.

- No. 1. *Gorgonia Agassizii* Verrill. Original specimen.
- No. 2. *G. aurantiaca* Verrill. Authentic specimen.
- No. 3. Four eggs of *Falco anatum*, from Mt. Tom, Mass.
- No. 4. Twelve species of moths (*Bombycidae*) from original specimens described by Dr. A. S. Packard, Jr.
- No. 5. Nineteen species *Bombycidae* from original specimens of Packard.
- No. 6. *Samia* (*Platysamia*) *Columbia* Smith, male and female, cocoon and chrysalis from the original specimens.
- No. 7. Various rare or new Insects. Collection of A. S. Packard, Jr.
- No. 8. Quarternary (Drift) Shells, rare species. Coll. Packard.
- No. 9. Drift shells, Maine, Labrador, &c. Coll. Packard.
- No. 10. *Mussa crepa* Dana. Original specimen.
- No. 11. Section of nest of Common Wasp.
- No. 12. Three teeth of *Bison*. Drift fossils, Gardiner, Me.

All the preceding, except Nos. 1, 10 and 11, which are reduced one half, are of natural size.

The stereoscopic sizes will be sent by mail, postage prepaid, at 50 cents each, or the set of 20 for \$8. The larger sizes at 75 cents each, or the set of 12 for \$8. Address F. W. PUTNAM, Essex Institute, Salem, Mass., or PROF. A. E. VERRILL, Yale College, New Haven, Conn.

CORRECTIONS TO THE DIRECTORY.

- No. 23. E. T. COX. Should be *North American*.
 No. 90. DR. NEWBURY is now Professor of Geology in Columbia College. For correct address see No. 341.
 No. 171. Should be CHRISTIAN FEBIGER.
 No. 319. MR. HYATT, is now residing in Salem. For correct address see No. 482.

ADDITIONS TO THE DIRECTORY.

MINERALOGY.

- 243, a. Prof. G. C. SWALLOW, (State Geologist of Missouri and Kansas), Columbia, Boone Co., Mo.
 201, a. J. B. KEVINSKI, Lancaster, Pa. *Local*.

GEOLOGY.

- 4, a. WILLIAM ANDREWS, Cumberland, Md. *Local*.
 27, a. DR. JOHN DE LASKEI, West Falmouth, Me. *Local*. *Special*, *Glaciers*.
 58, a. JAMES HYATT, Bengall, N. Y. *Local*.

PALÆONTOLOGY.

- 276, a. WILLIAM ANDREWS, Cumberland, Md. *Local*.

NOTICES OF PROPOSED WORKS ON NATURAL HISTORY.

TRYON REAKIRT, 335 North 3d street, Philadelphia, Pa.

Is engaged in preparing a Synopsis of the Diurnal Lepidoptera of the Rocky Mountains and Trans-Mississippi Plains. Mr. Reakirt would be happy to receive any specimens from these regions for examination.

ARTHUR M. EDWARDS, 115 John street, New York, N. Y.

Is preparing a work on the Bibliography of the Diatomaceæ; also a List of the described species of Diatomaceæ, with references to the original descriptions and figures; to be published in the Proceedings of the Essex Institute. For further information address Mr. Edwards.

PROF. JAMES HUBBERT, St. Francis College, Richmond, Canada East.

Is preparing a work on the Botany of Canada, entitled *A Handbook of the Canadian Flora*, being a description of the flowering plants, ferns and mosses indigenous to or naturalized in Canada. A comparison of the Canadian Flora with that of Great Britain, and especially with that of the highlands of Germany will be given, and particular attention will be paid to the limitation of species.

REV. DR. M. A. CURTIS, Hillsborough, N. C.

Is preparing a work on the principal eatable species of Mushrooms and other Fungi, of this country, with colored figures.

DESIDERATA AND SPECIMENS FOR SALE AND EXCHANGE.

ALPHEUS HYATT, Essex Institute, Salem, Mass.

Offers to exchange identified specimens of Fresh water Polyzoa, from various localities in New England, for specimens from any other locality.

PROF. H. C. WOOD, JR., Academy of Natural Sciences, Philadelphia, Pa.

Solicits Myriapods or Centipedes, and Phalangidæ or "Daddy-long-legs," from all parts of North America. The former in order to perfect his published monograph on the North American species of the group, and the latter with the intention of monographing them. They should be preserved in alcohol or very strong whiskey in small mouthed bottles. All collections will be returned labeled, if desired. The smaller species are especially desired, also any notes on the habits of any of the species. Prof. Wood has a few copies of his monograph of the Myriapoda of North America which he will give for really valuable collections. The Phalangidæ may be distinguished from the true spiders by the head not being distinct from the abdomen.

DR. S. C. WILLIAMS, Silver Springs, Lancaster Co., Pa.
Minerals and Local Insects for exchange.

H. G. BRUCKHART, Silver Springs, Lancaster Co., Pa.
Local Mollusks and Coleoptera for exchange.

N. VICKARY, 262 Chestnut St., Lynn, Mass. (Taxidermist and Dealer).
Has Birds and other specimens for sale or exchange.

DR. F. STEIN, Museum der k. Universität, Berlin, Prussia.

Has for sale the following Insects from the collection of the late Dr. Schaum. Elatrides (7 boxes), 200 Thalers; Buprestides (4 boxes), 75 Thalers; Chrysomelides (23 boxes), 150 Thalers; Scydmenides and Pselaphides (number not given), 120 Thalers; Cerambycides (European), 40 Thalers.

THE WALKER PRIZES.

"The following prizes were founded by the late DR. WILLIAM J. WALKER, for the best memoirs, and in the English language, on subjects proposed by a committee appointed by the Council of the BOSTON SOCIETY OF NATURAL HISTORY. The first and second are to be awarded annually; the third, once in five years, beginning 1870.

First—For the best memoir presented, a prize of sixty dollars may be awarded. If however, the memoir be one of marked merit, the amount awarded may be increased to one hundred dollars, at the discretion of the committee.

Second—For the next best memoir, a prize not exceeding fifty dollars may be awarded at the discretion of the committee: but neither of the above prizes shall be awarded unless the memoirs presented shall be deemed of adequate merit.

Third—GRAND HONORARY PRIZE.—The Council of the Society may award the sum of five hundred dollars for such scientific investigation or discovery in natural history as they may think deserving thereof; provided such investigation or discovery shall have first been made known and published in the United States of America;

and shall have been at the time of said award made known and published at least one year. If in consequence of the extraordinary merit of any such investigation or discovery, the Council of the Society should see fit, they may award therefor the sum of one thousand dollars.

Subject of the Annual Prize for 1866-7. "The fertilization of plants by the agency of insects, in reference both to cases where this agency is absolutely necessary, and where it is only accessory;" the investigations to be in preference directed to indigenous plants.

Subject for 1867-8. "Adduce and discuss the evidences of the coexistence of man and extinct animals, with the view of determining the limits of his antiquity."

Memoirs offered in competition for the above prizes must be forwarded on or before April first, prepaid and addressed

"Boston Society of Natural History,
for the Committee on the Walker Prizes,
Boston, Mass."

Each memoir must be accompanied by a sealed envelope enclosing the author's name, and superscribed by a motto corresponding to one borne by the manuscript." Boston, June, 1866.

THE ENTOMOLOGICAL SOCIETY OF PHILADELPHIA.

This Society, organized in the Spring of 1859, has earned for itself in the short period that has since elapsed, a name and reputation which might be envied by many of the oldest scientific associations in this country or in Europe. Devoted solely to the study of that branch of Zoölogy which its name indicates, its members have infused a spirit of energy and progress into its proceedings, which has accomplished in a few months more than the same number of years have effected in larger bodies endowed with more extensive means. In fact the unavoidable expenses of accumulating and maintaining a collection, of publishing its quarterly journal, &c., have been borne almost entirely by the late Dr. Thomas B. Wilson, of Philadelphia. The generous liberality of this keen student of Nature was checked by his sudden death, after an illness of less than a week, on Wednesday, the 15th of March, 1865. The Society which had been the object of his benevolence had every reason to expect a continuation of his bounty in the form of a bequest, from frequent expressions of his intentions, but his untimely death has placed them in such a position that they cannot continue their former useful career without the aid of all well disposed patrons of science. They are anxious to keep up the prestige of their publications, and for this purpose they ask subscriptions to a Fund of \$50 000, of which amount \$10 000 has already been realized and funded. To all subscribers of \$100 and upwards, an Honorary Membership is tendered, and the publications of the Society will be furnished free of charge during the life-time of the subscriber.

The importance of the work in which this association is engaged, cannot fail to be universally recognized at this time when our crops are yearly destroyed by new and strange insect enemies, whose diminutive size, mysterious transformations, and immense multitude, make us, in our ignorance of their habits, utterly powerless before them. On this subject a monthly bulletin, called the *Practical Entomologist*, is issued by the Society for distribution to any one forwarding their address and fifty cents per year to the Secretary of the ENTOMOLOGICAL SOCIETY OF PHILADELPHIA, No. 518 So. 18th street, Philadelphia, Pa. Any one remitting annually a sum of not less than *One dollar*, to the Secretary, E. T. Cresson, will be elected a Contributing Member of the Society, and will receive a Diploma to that effect.

THE PORTLAND SOCIETY OF NATURAL HISTORY.

We beg to call attention to the following appeal of this most unfortunate society, and to urge the friends of science to give what aid they can as promptly as possible, for every dollar received at this trying time will be more encouraging to the society than larger sums hereafter.

AN APPEAL TO THE FRIENDS OF SCIENCE.

"For the second time, the Portland Society of Natural History has been visited by a destructive calamity. Its new hall, with the furniture and all its collections, have again been destroyed by fire.

The origin of this Society must be referred to the organization of the Maine Institute in 1836. Though at first struggling with poverty, it was able to secure large collections in Natural History, and a valuable library of scientific books. These were, by the favor of the Government, placed in the Custom House, a spacious hall in that professedly fire-proof structure being assigned to the Society's use. In 1854, the burning of this edifice destroyed every species of property belonging to the Society. Not a vestige of its museum or library was left to serve as a memorial of the past.

But the spirit of the Society was not dead. A few individuals by their persevering labors raised a new cabinet from the ashes of the old. The State granted one half-township of land; subscriptions were set on foot; contributions flowed steadily in; and at last the Society was housed in a noble building, which six months ago it had lifted so far out of debt that it could begin to call this its own. It had a splendid hall of exhibition, fine lecture room and laboratory; while the collections made by some of the most faithful servants of science, or contributed from the East and West, adorned its walls. Publications of high scientific value had been issued from its press. A special Curator had just been regularly engaged, a repair fund gathered, courses of free lectures begun, new members were crowding to its ranks, all the signs of vitality and growth were large, when, in the terrible fire that left, in twelve hours only a desert where the commercial centre of Portland was, everything once more vanished like a dream. The building was isolated, fire-proof apparently, and in the judgment of all safe from harm, until the sweep of that awful tide of flame, which no masonry could withstand, closed in ruin over the cherished results of years of toil.

By this loss, the Society is again stripped of its all. Its insurance proved nearly worthless. Its mortgage debt will absorb the value of the land, the charred ruins and its remaining funds. The library and the fine picture of Humboldt, the splendid gift of the poet Longfellow, alone are saved. In the destitution, which these remnants of former wealth make more painful to consider, the Society is compelled to implore the aid of the friends of science everywhere to enable it to continue its work.

Brethren! whom God has spared the double affliction with which He has visited us, will you grant us your help? Our first need is a home—a building that we may re-consecrate to science. We can repair all other losses better than that. Our city is impoverished—our own selves involved in grief and loss—and if aid does not come from you, we know not where to turn. Will you give us the hand of sympathy—the open hand of benevolence, that we may again have a "local habitation and a name," and go on prosperously in the joyful work of studying and interpreting the book of Nature?

At a meeting of the Portland Society of Natural History, held July 9th, 1886, at the residence of Rev. E. C. Bolles, it was voted that the undersigned be a committee to make a brief statement of facts connected with the history of the Society, and appeal to the friends of science everywhere for aid in this critical condition of its affairs. To this Committee, or to any officer of the Society, all communications upon the subject may be addressed.

OFFICERS OF THE SOCIETY.WM. WOOD, *President.*HENRY WILLIS, *Vice President.*E. C. BOLLES, *Secretary.*EDW. GOULD, *Treasurer.***COMMITTEE.**

WM. WOOD, M. D.

REV. E. C. BOLLES.

CHAS. B. FULLER.

EDW. S. MORSE.

THE CHICAGO ACADEMY OF SCIENCES.

The collections of this Academy were partially destroyed by fire on the 7th of June last. The following quotation from the circular issued by the Academy gives its present condition.

"As nearly as can now be ascertained the present condition of the collection and property of the Academy is as follows:—

About half the Mammals and Birds, and nearly all the Skulls, etc., will be saved; the extensive collection of Birds' eggs and nests were entirely destroyed; Fishes and Reptiles are saved; Insects all destroyed with the exception of the Lepidoptera dried Crustacea and Echinodermata destroyed; Shells and Fossils in great part saved. Very singularly and fortunately, the alcoholic collection, contained in about 2000 jars, has escaped. The Herbarium, with the exception of the series of the plants of the North Pacific Expedition, is saved. The Library is greatly damaged by water but most of the books will be saved by careful drying and rebinding. The plates of the forthcoming volume of the Transactions, twenty in number, were much injured, and some of the edition may have to be reprinted. The publication of the volume, will not, however, be greatly delayed."

We understand that the Academy will proceed at once to erect a fire-proof building for their collections and library, which, we trust, will, by the aid of kindred societies and friends, soon be larger than before the disaster.

The several disasters to scientific institutions during the last year, should warn all our Societies and Institutions having valuable collections and libraries, to secure fire proof buildings for them at once.*

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The fifteenth meeting of the American Association was held at Buffalo, N. Y., from August 15th to 21st. Since the commencement of the war these meetings have been suspended and we are glad that they were renewed under such pleasant auspices as attended this meeting, and that the citizens of Buffalo so fully appreciated the value of the Society and were so cordial in their entertainment of its members.

*The collection of the Lyceum of Natural History of New York, was wholly destroyed by the burning of the Academy of Music in May last. We wait for official information in regard to this Society and its future movements.

The officers for this meeting were, *President*, F. A. P. BARNARD, *President* of Columbia College; *Vice President*, A. A. GOULD, M. D., of Boston; *General Secretary*, Prof. ELIAS LOOMIS, of Yale College; *Permanent Secretary*, Prof. JOSEPH LOVERING, of Harvard College; *Treasurer*, A. L. ELWYN, M. D., of Philadelphia.

The next meeting of the Association will be held at Burlington, Vt., commencing August 21st, 1867. The following are the officers elected for the meeting: *President*, Prof. J. S. NEWBERRY, of New York; *Vice President*, Prof. WOLLCOTT GIBBS, of Cambridge; *Permanent Secretary*, Prof. JOSEPH LOVERING, of Cambridge; *General Secretary*, Prof. C. S. LYMAN, of New Haven; *Treasurer*, Dr. A. L. ELWYN, of Philadelphia.

We think that it would, perhaps, have been more advisable to have had the meeting for 1867 held at a more central city, which would have induced a larger number of members from the West and South to attend, but still we hope that, notwithstanding the extreme northern location of the meeting, members from all the states will endeavor to be present and maintain its character as an *American Association*.

OBITUARY NOTICES.

REV. STILLMAN BARDEN, of Rockport, Mass.; well known as a mineralogist, died at his residence on August 7, 1865, of consumption. Mr. Barden was an active and enthusiastic collector and a thorough lover of nature. He had gathered a large cabinet of minerals which will be kept up by his son Edward, who has inherited his father's taste for mineralogy.

DR. SIMON SHURTLEFF, of Westogue, Hartford Co., Ct., a general student of nature and especially interested in Botany, Ornithology and Conchology, died at his residence on December 29, 1865.

THOMAS DANIELS, of Cincinnati, Ohio, died in January, 1866. Mr. Daniels was known to many naturalists as a student of Paleontology.

WILLIAM GLEN, of Cambridge, Mass., died of consumption at his home on May 25, 1866. Mr. Glen was a native of Scotland and came to this country in 1854. For several years he was an Assistant in the Museum of Comparative Zoölogy, at Cambridge. He was a person of most remarkable skill in his manipulations, and certainly had no superior in preparing sections and microscopical objects. By the sad death of Mr. Glen science has lost a careful, enthusiastic and faithful worker.

PROFESSOR HENRY DARWIN ROGERS, LL. D., F. R. S., &c., of Glasgow, Scotland, died at his residence in Shawlands, near Glasgow, on Tuesday, May 29, 1866, soon after his return from a visit to the United States. In 1857, Professor Rogers was called to the chair of Regius Professor of Geology and Natural History in the University of Glasgow, which he filled to the time of his death. His intimate connection with the Geology of America, and especially his great work on the Geology of Pennsylvania, will ever endear his name to American Naturalists. He was born in Philadelphia in 1809.

PROCEEDINGS
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1870.

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RESIDENT MEMBERS ELECTED.

Adams, J., 11.	Harris, M., 9.	Perkins, B. C., 4.
Allen, B. R., 53.	Hall, G. B., 27.	Preston, H. W., 53.
Allen, N. K., 4.	Haskell, W. W. G., 53.	Preston, S., 53.
Allen, W. B., 27.	Howland, W., 4.	
Andrews, G. W., 4.	Hull, W. H., 10.	Russell, B. W., 8.
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Brown, S. A., 16.	Kidder, J., 53.	Smith, S. H., 8.
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Cressy, B., 53.	Lord, E. A., 27.	Turner, L. H. P., 27.
	Lynde, S. A., 27.	
Dudley, A. M., 4.		Upton, L. H., 8.
	Mudge, A., 4.	
Eaton, W. W., 4.		Warren, L. F., 8.
	Nichols, S. B., 41.	Waters, D. P., 12.
Farley, G., 4.	Niven, J., 27.	Wentworth, F. W., 4.
Furbush, J. W., 15.		Wheatland, G. Jr., 22.
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DECEASED MEMBERS.

Andrew, J. A., 17.	Johnson, D. H., 17.	Page, C. G., 17.
Denslow, W. W., 55.	Joselyn, H. S., 17.	Page, J., 17.
Doyle, Mary, 17.	Kimball, E. D., 17.	Peabody, F., 17.
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Frye, N. A., 17.	Mackintire, S., 17.	Roberts, W. S., 17.
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PROCEEDINGS

OF THE

ESSEX INSTITUTE.

MONDAY, JANUARY 25, 1868.—Social Meeting at Hamilton Hall.
Vice President A. C. GOODELL in the chair.

AFTER some preliminary business, and remarks by the chairman, Rev. E. C. BOLLES of Portland was introduced and spoke of the microscopic structure of plants.

The address was an eloquent statement of the nature, form, growth and multiplication of vegetable cells; full of beautiful descriptions of the methods and operations, revealed only by the microscope, by which from their respective germs are evolved the forms alike of the stateliest trees of the forests and minutest mould or plant that microscopy has revealed.

JOHN D. PHILBRICK, of Boston, well known from his labors in behalf of popular education, made a few remarks on the value of Scientific knowledge to the school teacher, and the importance of the study of natural history in our system of instruction.

The meeting then adjourned, and the company was invited to examine the objects placed under the microscopes, illustrative of the remarks of the lecturer. A collation and social entertainment closed the programme for the evening.

Diagrams drawn with white and colored crayons upon the Black-board, by Mr. E. S. MORSE, were used in illustration of the subject. On the walls were suspended several of the magnificent lithographs of Allen's *Victoria Regia*. Around the room were arranged thirty-six Microscopes under which were placed slides containing specimens of transverse and longitudinal sections of exogenous and endogenous plants; of leaves, cuticle, spores, pollen; and sections of coal and hard vegetable tissue; most of them were prepared by Mr. E. Bicknell.

LIST OF OBJECTS.

Exogens:—No. 1. Transverse section of Spruce (*Abies alba*), showing cells cut through; 2. Longitudinal section of the Spruce, radial, showing glandular dots, colored; 3. Longitudinal section of the Spruce, tangential, showing glandular dots cut through, colored; 4. Longitudinal section of California "Big Tree" (*Sequoia gigantea*); 5. Transverse section of Oak (*Quercus bicolor*); 6. Transverse section of Basswood (*Tilia Americana*), showing bast cells; 7. Longitudinal section of Basswood, showing spiral cells, colored; 8. Transverse section of Birch (*Betula alba*); 9. Transverse section of Blackberry (*Rubus villosus*), colored; 10. Transverse section of Clematis (*C. Virginiana*), colored; 11. Transverse section of Aristolochia (*A. siphon*), colored; 12. Transverse section of Evening Primrose (*Oenothera biennis*), showing dotted ducts.

Endogens:—13. Transverse section of Malacca Joint (*Calamus scipionum*); 14. Transverse section of Bamboo Cane (*Bambusa*); 15. Transverse section of Sarsaparilla (*Smilax excelsa*); 16. Transverse section of Corn Stalk (*Zea Mays*); 17. Transverse section of African Ginger Stalk (*Zingiber*); 18. Transverse section of Leaf Stalk of Banana (*Musa*).

Leaves, Cuticle, Algæ, etc.:—19. Transverse section of Leaf of Oleander, showing midrib; 20. Leaf of *Deutzia scabra*, showing stellate hairs; 21. Leaf of Geranium (*Pelargonium*), showing cells; 22. Leaf of Bog Moss (*Sphagnum*), showing spiral cells; 23. Cuticle of Lily, showing stomata; 24. Algæ, Fresh water (*Draparnaldia plumosa*); 25. Algæ, Marine (*Polysiphonia urceolata*); 26. Marine (*Ptilota elegans*); 27. Elaters and spores of Jungermannia; 28. Mallow anther and pollen; 29. Crystals from bark of Locust; 30. Crystals from skin of Onion.

Hard Tissues:—31. Section of Coal, showing vegetable structure; 32. Section of Vegetable Ivory (*Phytelephas macrocarpa*); 33. Horizontal section of the husk of do.; 34. Section of Prune stone; 35. Stellate hairs from *Deutzia*; 36. Section of Coconut shell.

MONDAY, JANUARY 13, 1868.—Regular Meeting.

Vice President GOODELL in the chair.

Correspondence and donations announced.

Dr. G. B. LORING read an able and interesting communication on the life and character of Chief Justice Parsons.

Dr. Loring commenced by an allusion to the distinguished men of Essex County, and to what they have performed for the elevation of mankind and for the glory and honor of our common country; to Lieut. Gov. Phillips who founded the Theological Seminary at Andover; to Abbott and Stuart and Woods as theologians; to Story and Parsons and Prescott and Putnam and Saltonstall and Pickering and Rantoul as lawyers; to Jonathan Jackson and Peabody and Perkins and Pickman and Derby as merchants; to Prescott as a historian, Whittier as a poet, and Hawthorne as a novelist; to Bowditch as a mathematician. Of all these he selected Theophilus Parsons, as one of the most remarkable. He was born in Byfield, February 24th,

1750. His father was Rev. Moses Parsons, descended from a merchant who died in Gloucester in 1689. His mother was Susan Davis, descended from John Robinson of Leyden, the Puritan minister. The frugal life of the early New England clergy was described—the salary of Mr. Parsons being \$280 a year, and requiring his labor on his farm and occasional sporting on the marshes to support his family. He was the general adviser of all matters secular and religious in his parish, when he was settled for life. Theophilus Parsons entered college at Cambridge in 1765; was graduated in 1769; taught school and studied and practiced law in Falmouth until 1775; returned on the burning of that town by the British, to Byfield; met at his father's house, Judge Trowbridge, who had fled from Cambridge for the safe enjoyment of his toryism, whom Chancellor Kent calls "the oracle of common law in New England," and whose library was invaluable to the young law student; and in a short time settled as a lawyer in Newburyport. Here he married Elizabeth Greenleaf, Jan. 13, 1780, built a house on Green street, lived there twenty years; removed to Boston in 1800, was appointed Chief Justice of Massachusetts in 1806, and died Oct. 30, 1813. Not a very eventful life in a very eventful period. While the great work of the revolution was going on he was a quiet lawyer in Newburyport. He had great love of his profession, and great powers which would have distinguished him in any sphere of life. While residing in Newburyport, in 1778, when he was twenty-eight years old, the question of a Constitution for Massachusetts was presented to the people. There was great popular jealousy against all law and all lawyers—Dr. Loring read a curious extract from a letter written by W. Symmes, Jr., of Andover, to Isaac Osgood, Clerk of the Courts in Essex County, at that time, to show the difficulties under which lawyers labored in those days. While the question of the State Constitution was pending, young Parsons called a meeting of the citizens of Newburyport, March 27th, 1778, and issued a circular to the selectmen of the several towns in Essex County, to meet by delegates in a convention to meet in Ipswich in April of that year. Among the delegates appear the names of Theophilus Parsons, Tristram Dalton, Jonathan Greenleaf, Jonathan Jackson and Stephen Cross of Newburyport; of Ward, Goodhue, Andrews, Goodale and Sprague of Salem; Putnam and Shillaber of Danvers; Farley and Noyes of Ipswich; Coffin and Porter of Gloucester; Gould and Clarke of Topsfield; Dodge of Wenham; Perley of Boxford; and "the Hon. Caleb Cushing, Esq., of Salisbury." This convention sent forth the famous "Essex Result," a paper written by Parsons, and containing sound theories of government. "It was an earnest endeavor to discover and declare how progress and conservatism, liberty and order, might be adjusted in human institutions, that freedom should be secure, and peace and happiness be the children of freedom." Upon his suggestions was based the first Constitution of Massachusetts, carried as they were by the young lawyer of Newburyport, into the subsequent state convention, and submitted to the Bowdoin and Adamses, and Lowells, and Pickerings, and Stronges of that distinguished body.

After this Parsons retired from politics, was engaged in private practice for ten years, and did not emerge again until the Constitutional Convention of 1788. In this convention, when there was great danger of rejecting the Federal Constitution, he offered his well known "conciliatory resolution." That it might be explicitly declared that "all powers not expressly delegated to Congress are reserved to

the several states, to be by them exercised." This is the first declaration of the doctrine of State Rights. It secured the adoption of the Constitution, and drew from John Adams the statement that "our Constitution was made for a moral and religious people; it is wholly inadequate to the government of any other."

Having accomplished this work, Parsons again retired to his profession, to receive the highest honors which the law can bestow. Under his administration as Chief Justice, the confusion and complication which had attended the forms of practice here, began at once to disappear; and to him more than any other may be attributed the reformed state of the dockets throughout the Commonwealth, the promptness of decisions, the regularity of trials, attesting the beneficial effects of a system which he did so much to render popular and permanent.

As a jurist he was undoubtedly among the great lawyers of this county and state. To a citizen of Essex County the name of Story will at once occur as a contestant for the highest judicial distinction among us. Story and Parsons, both learned in the law, both endowed with large intellect, both possessing a high moral tone — and yet how different! The one diffuse, impetuous, unconstrained — the other concise, systematic, condensed, exhausting. Parsons left the most law — Story the most books. Parsons cut his path directly to the object — Story led his followers through devious paths obstructed by difficulties of which he never lost sight. Parsons loved the sharpest analysis — Story delighted in an accumulation of all that related to his subject. Parsons was a great thinker — Story a great talker. Parsons gave his opinion to a jury — Story gave the argument. Parsons never forgot that he was a judge — Story never forgot that he was a lawyer. Parsons was an accurate mathematician, a careful student, a good scholar. Story's proper sphere was in the walks of his profession. The piercing, penetrating eye of Parsons was always directed upon the point aimed at — the eye of Story roamed through all space. Both had industry, both had humor, both had a kind humanity, both had deep faith. Both had a certain intellectual arrogance, the prevailing reproach of all great human powers, and both had that genuine kindness and private affection which attend all true greatness.

Mr. H. M. Brooks, after a few remarks, moved that the thanks of the Institute be presented to Dr. Loring for the paper read this evening and that a copy be requested for the archives.

N. K. Allen, B. H. Osgood and E. A. Smith of Salem; B. C. Perkins, A. M. Dudley of South Danvers; William Howland, of Lynn; W. W. Eaton, Edward Hutchinson, Augustus Mudge, Frederic W. Wentworth, George Farley, and George W. Andrews, of Danvers, were elected Resident Members.

MONDAY, JANUARY 20, 1868. — Regular Meeting.

Vice President GOODELL in the chair.

Correspondence and donations announced.

The following notes, received from Dr. HENRY SHIMER, of Mt. Carroll, Ill., were communicated by Mr. Putnam :

On Sept. 20, 1864, about 9 A.M., a mild delightful autumn morning, while walking in the field, I passed by a previously observed nest of humble bees. This in the working season had been a powerful colony. At this time I was particularly attracted by a number of the bees flying about the hole, or remaining poised in the air a short distance from the hole as if in the act of fanning the opening. A little observation convinced me that these were all male or drone bees; I then ventured nearer and tore the nest out of the ground. Several large female or queen bees came out of the nest and crawled or fluttered slowly along over the ground. Now the males, which I previously saw flying around and fanning at the hole, eagerly darted upon these females. Four males darted at the first female that came out of the nest piling upon each other over the back of the female, wrestling and struggling with might and main for the prize. One more philosophical than the rest, observing the crowd upon her back, alighted on her side and twisted around beneath embraced her belly to belly, and thus formed in the midst of the excited struggling crowd the sweet nuptial embrace. I saw several such piles of two, three, or more males on one female.

The fanning at the hole which I observed by the males, was either anxious watching for the exit of the female, or their insect method of wooing, enticing them to come out, not being willing to deprive them of their virginity unwillingly within their habitation.

The neuters were all gone, no honey in the nest, which was full of worms. The bees remaining manifested none of that combative disposition which we always observe in midsummer.

I have seen many nests of the humble bee at all times during the whole summer, and never, however hot the day, have I seen them fanning at the hole during the breeding seasons. I am, therefore, convinced that Mr. Angus was wrong in his opinion that the fanning was for the purpose of introducing air into the nest. If this could be the object, then in the hottest days of midsummer it would be really if ever, needed, but then I have never seen it, on the contrary it is only in autumn that I have seen this interesting phenomena, the object, of which I am well satisfied, was in all cases which I have observed, the same as I verified by opening the nest as above set forth.

Mr. A. HYATT described the geological structure of the region of the Adirondacks and its border of fossiliferous rocks, and exhibited some specimens gathered during the past summer from those fossiliferous strata, and in other parts of New York State.

The central region of the Adirondacks is bordered on all sides, except where a narrow neck of primitive rock connects with the primitive rocks of Canada, by fossiliferous strata containing numerous remains. This shows that at one time this mountainous region was a peninsula almost wholly surrounded by water and the fossils enable us to repopulate the sea with the strange plants and shells which then inhabited its beaches. No fishes enlivened the shallow sea, but the bottom was carpeted by succulent, thick stemmed seaweeds, and where stretches of bare ground intervened, crabs not unlike our horse-shoe were strewn over the solid beds of lamp shells, now represented on our coast by only two species. The climate was mild and there is every reason to believe that the whole surface of the peninsula was devoid of vegetation, an arid, barren waste, like all the other

dry land at this early period of creation. From the earliest beginning of life in this period until the introduction of fishes there is a series of gradual changes in the character of the animals and plants, but no sudden cataclysms or miraculous creations. The new forms which appear are intermingled more or less with the old, and the whole is a gradual progression, in which the first created and simplest are almost imperceptibly supplanted by more highly organized beings.

Mr. F. W. PUTNAM followed Mr. Hyatt, and alluded to the fact that Lake Champlain having been an estuary of the ocean at a comparatively recent period, that of the Quaternary, as shown by the remains of marine shells and other marine animals found in the clay banks of the lake were identical with species now living on the coast of Maine.

It is a matter of some interest to ascertain where the fresh water fishes and other animals now inhabiting the lake came from. On making a comparison of the fishes of Lake Erie with those of Lake Champlain he was satisfied that the majority of the species were the same, and that Lake Champlain had been supplied with its inhabitants from the Great Lakes and the rivers flowing into the lake.

Mr. E. S. MORSE stated that the same faunal connection was shown in the mollusca of that lake, and mentioned several species identical with those of the Great Lakes and unlike any found east of Lake Champlain.

Mr. MORSE mentioned that he had found among the collection of shells made by Mr. Joseph True of Salem, which had been presented to the cabinets of the Institute by a friend, several interesting specimens, one of which, a species of *Limnadia*, belonging to the order of Phyllopoda, appeared to be entirely new.

The following communication was received from CHARLES WRIGHT, of Cambridge :

AMMANNIA LINGULATA, *Gris.* : — Mr. Grisebach established this species on specimens from Cuba, and it may interest botanists to know that it belongs also to the United States. The only distinctive character assigned is the short style. This at once suggested the idea that it might be a case of dimorphism now known to be so common. As I have just given these plants a patient examination I will state the conclusions to which I have come. So far as the specimens at my disposal indicate, *A. lingulata* Gris. is a stout plant, with larger flowers, larger fruit and seeds, twice the size of those of *A. latifolia* Linn. as well as different in form and color. These all, of themselves, would not be sufficient, perhaps, if the dimorphism could be shown. But in this latter case, generally, if not always, the extraordinary development of one organ or set of organs is accompanied by the greater or less reduction of the other. In our plant such is not the case. The stamens and style are quite hidden within the calyx, and the filaments are very short, while in *A. latifolia* both are exerted. It is, however, but fair to say, that in a specimen from Illinois. I saw one or two styles somewhat lengthened. I have examined specimens of *Ammannia humilis* and find in them no sign of dimorphism.

The seeds of *A. latifolia* are darker in color, or of a light brownish,

concavo-convex, incurved at the ends, and little, or not at all angled on the inner (concave) side by the funiculus. Those of *A. lingulata* are yellowish or pale straw color, and very perceptibly angular on the concave side. The leaves are so much alike that a character can hardly be drawn from them. On the whole, then, though not quite convinced that we have allowed, all these years, two species to pass under one name, the differences indicated above, if not sufficient to satisfy all that we here have two well marked species, they are interesting enough to excite farther enquiry, and to settle the question one way or another.

Some one may, very naturally ask, how shall we know which is the original *A. latifolia*. This I cannot tell, and I fancy it can only be decided by reference to the original so named by Linnæus. Mr. Grisebach's Jamaica specimen has the long stamens and style. In Cuba, so far as I can judge by my specimen, it must be rare; as nearly all that I have dried there belong to *A. lingulata*. If Mr. Grisebach's attention had been directed to this point when in the new Herbarium, he might have decided it and perhaps he did.

MONDAY, JANUARY 27, 1868.—Regular Meeting.

Vice President GOODELL in the chair.

Correspondence and donations announced.

Mr. G. L. STREETER read a very interesting paper on Salem as it was one hundred years ago. He described persons, places, incidents and social customs with vividness, and presented a graphic picture of the old town as it appeared just previous to the breaking out of the Revolutionary War.

He commenced by an account of the establishment in Salem, in 1768, of the Printing Press of Samuel Hall, our first printer, and the projector of the "Essex Gazette," and proceeded to give a minute statement of the condition of the town as it then was. He sketched the outlines of its exterior appearance, the streets, public and private buildings, and street scenes and daily life, describing with particularity some of the more elegant residences, and giving detailed accounts of the Churches, Taverns, and of the old Town House and other public buildings on School street. He then passed to an account of the business of the place, its commercial interests, the wharves and shipping. The state of public opinion upon religious and political subjects was also spoken of. The social condition of the place, the style of dress, the modes of travelling, the amusements and recreations of the community were reviewed at length. The principal inhabitants and social aspect of the town were touched upon in passing.

The political status of the town with reference to the approaching revolution was exhibited quite fully, with the purpose of showing the violence of the contest, the nature of the feelings and sentiments involved, and the progress of events. The principal persons in the town on each side were introduced and particularly noticed. The exciting events at about the time of Gov. Gage's visit here occupied considerable attention, and he gave a personal account of the princi-

pal tories who were driven from the town, and also of the leading whigs who remained to control its society.

On motion of Mr. J. KIMBALL the thanks of the Essex Institute were tendered to Mr. Streeter for his interesting communication, and a copy of his paper was requested for the archives.

Benjamin W. Russell, Lucy Houghton Upton, George B. Appleton, Samuel H. Smith, Benjamin Whitmore and L. F. Warren, all of Salem; and Francis Baker of South Danvers, were elected Resident Members.

MONDAY, FEBRUARY 3, 1868. — Regular Meeting.

Vice President GOODELL in the chair.

Correspondence and donations announced.

Mr. HORACE MANN of Cambridge delivered a lecture, introductory to a course, on Elementary Botany.

MONDAY, FEBRUARY 10, 1868. — Regular Meeting.

Vice President GOODELL in the chair.

Correspondence and donations announced.

Mr. R. S. RANTOUL read a paper upon the past and present modes of travel and conveyance, a large portion being devoted to the history of the Eastern Stage Company, derived mostly from its records now in the possession of the Institute, and presented a very graphic picture of travel in the old stage coaches and life upon the road.

On motion of Mr. PUTNAM the thanks of the Institute were tendered to Mr. Rantoul, and the paper was referred to the Publication Committee.

William O. Johnson of Salem was elected a Resident Member.

MONDAY, FEBRUARY 17, 1868. — Regular Meeting.

Vice President GOODELL in the chair.

Correspondence and donations announced.

The hour of the meeting was occupied by Mr. HORACE MANN of Cambridge with his second lecture on Botany.

Some specimens of *Beche de mer* having been placed upon the table, elicited remarks from Messrs. G. D. PHIPPEN, F. W. PUTNAM, and G. A. PERKINS, on its natural history, and the mode of preparation as an article of commerce with the Chinese. Mr. PUTNAM gave an ac-

count of a peculiar genus of fishes (*Oxybeles*) which have been taken from Holothurians.

Benjamin F. Spinney of Lynn was elected a Resident Member.

MONDAY, FEBRUARY 24, 1868. — Regular Meeting.

Vice President GOODELL in the chair.

Correspondence and donations announced.

The CHAIR read the programme of a course of lectures to be delivered in the Lyceum Hall, under the direction of a committee of the Institute, commencing on Thursday, March 5.

JONATHAN KIMBALL read a communication on the School Houses of the olden times, more especially those that were found in our country towns, contrasting the condition of things in the early period of our history with that of the present day. The paper was one of much interest and value, and it enlisted the undivided attention of a large audience.

On motion of Dr. G. A. PERKINS, the thanks of the Institute were tendered to Mr. Kimball for his valuable communication, and a copy of the same was requested for deposit in the archives.

The CHAIR, Messrs. PHIPPEN, KIMBALL, UPHAM and others, made remarks, suggested by the paper of the evening.

Mason Harris of Marblehead was elected a Resident Member.

MONDAY, MARCH 2, 1868. — Regular Meeting.

Vice President GOODELL in the chair.

Correspondence and donations announced.

Mr. HORACE MANN of Cambridge occupied the hour with his third lecture on Botany. Subject: the formation of cells in the structure of stems.

MONDAY, MARCH 9, 1868. — Regular Meeting.

Vice President GOODELL in the chair.

Correspondence and donations announced.

Dr. HENRY WHEATLAND read a paper containing notes on the Teachers of the olden times; also a brief account of female education in the Public Schools of Salem.

Dr. W. stated that his subject was suggested by the highly interesting communication read at the last historical meeting by Mr. Kimball.

the able Superintendent of Schools in this city, on the "School Houses of the olden time."

Rev. John Fiske was the earliest teacher. He was born in 1701, and removed to America in 1637, and resided at Salem three years, performing the double office of preacher and tutor. Among his pupils was the famous Sir George Downing. After giving an account of Mr. Fiske and his descendants, Dr. W. mentioned the other succeeding teachers in the early years, Edward Norris, Daniel Epes, Samuel Whitman, John Nutting, Peter Frye, William Walter, Nathan Goodale, John Watson, Isaac Hooker, Edward Lang, and others. In this connection allusion was made to two of the old school mistresses, who kept private schools for a long period, Mrs. Susanna Babbidge, and Miss Mehitable Higginson.

The first provision made for female teachers in Salem, was in 1764. In 1793 girls were first admitted to the Grammar schools, though under very unfavorable conditions. In '827 the first permanent arrangement was made for female education, by the establishment of two female Grammar schools, one in the eastern and the other in the western section. From that time the new system became more fully developed. In 1845 the High school was organized and became one of our highest and most valuable seminaries. A particular account was given of the origin of the Normal school in Salem, dedicated in Sept., 1854. The union of the High and Classical schools in the new building in Broad street extended the advantages of a good classical education, which under the old system was very imperfect. The city is much indebted to the late Hon. S. C. Phillips for awakened zeal in these matters which still continues with unabated vigor.

On motion of Mr. E. S. MORSE, this paper was referred to the publication committee. Remarks were made by Mr. KIMBALL, Superintendent of Schools, and others.

Mr. W. P. UPHAM read a copy of the earliest reference on the town records to a free school, viz.: Sept. 30, 1644. Also a deed by John Cross of Ipswich, dated Dec. 6, 1650, giving ten shillings a year forever, for a free school in Ipswich, and binding his farm therefore.

Mr. KIMBALL referred to the origin of free schools in Dorchester.

William H. Hull, of Salem, was elected a Resident Member.

MONDAY, MARCH 16, 1868. — Regular Meeting.

Vice President GOODELL in the chair.

Correspondence and donations announced.

Among the donations particularly noticed were specimens of the Black Rat, taken at Hancock, N. H., presented by Mr. BENJ. GOODHUE of that place. This rat, once better known than the brown rat, is rapidly diminishing since the introduction into its haunts of the latter species. Its original locality is not well known. According to some authors it was brought to this continent about the year 1544, and spread to such a degree as to have been apparently more abundant here than in the old world. Other authors have insisted that the species originally came from America, but of this there is much doubt.

Another addition to the Museum deserving of special notice is a

beautiful specimen of "Venus' Flower Basket," *Euplectella speciosa*, from the island of Zebu, of the Philippine group, presented by Capt. DANIEL H. HUTCHINSON. This is a silicious sponge attached by its expanded base to some marine body, supported by a skeleton, of a cylindrical tubular form, composed of numerous elongated fibres, consisting of fascicules of very long slender spicules, forming a square network, which, with its lightness, elegance and rigidity, give the idea of a beautiful, complicated piece of glass lace work.

Mr. HORACE MANN of Cambridge gave the fourth lecture of his course on elementary Botany.

He spoke of the growth of the stem, the vascular tissue, medullary rays, the bark and its uses; cork, which is a growth of the bark of some trees, more especially of the *Quercus suber*, or cork oak of southern Spain; the mode of collecting and preparing for commercial uses the *liber* of some plants used for cordage and various textiles. The deposit of vegetable or mineral matter in the cells gives the different degrees of hardness to the wood, and hence its adaptability for various uses in the arts. He also noticed the uses of pith, as the Sago in some species of Palm; Rice Paper, obtained from a species of *Aralia*, and the manner of obtaining and preparing the same by the Japanese.

He then alluded briefly to the growth of the Endogens, and described the germination of the cocoanut, one of the largest and noblest of this part of the vegetable kingdom, and closed his remarks by speaking of adventitious roots, and the growth of abnormal stems, as in the Dutchman's Pipe, one of the most simple of these aberrant forms, consisting of alternate layers of wood and bark, the new growth forming outside of the bark instead of pushing the bark out and forming a layer within; another form where the growth falls on one side of the stem and makes the increase on the opposite side, as in some vines. The mention of other forms of peculiar growth of the stems of plants concluded the interesting lecture.

Joseph Adams, of Salem, was elected a Resident Member.

MONDAY, MARCH 23, 1868. — Regular Meeting.

Vice President GOODELL in the chair.

Correspondence and donations announced.

Among the letters read was one from R. S. RANTOUL, Esq., tendering to the cabinets the die and wax impression taken therefrom, of the seal of the naval office for the district of Salem and Beverly. This die was given to Mr. R. by a gentleman who bought it in Boston with a collection of rare coins, medals, etc., and desired that it should find its way to the Institute.

The naval office was abolished by act of Congress, approved Feb. 28, 1865. When it was established is not known to the writer. Salem has been a port of entry since Feb. 7, 1683. The die has a pine tree in the centre surrounded by the words "Naval Office, District of Salem and Beverly." The pine tree was a favorite device in New England. It was on the coinage as early as 1652, and on the flag of

Independence adopted by our General Court, April 11, 1776, a white flag, with a green pine tree in the middle. This flag, the first standard bearer of liberty, was hoisted at Salem, Felt thinks, as early as March, 1775, and Salem was the first place reported in England as having raised it. Mr. R. writes that no such die as this has been used at the Custom House for many years, and is unable to give any satisfactory account of it.

Mr. GEORGE D. PHIPPEN occupied the hour of the evening in pleasant and interesting remarks on some points in botany, suggested mainly by the lectures which Mr. Horace Mann is delivering at the rooms of the Institute on alternate Monday evenings.

Botany may be considered under four great heads, or divisions. Physiological, Systematic, Geographical and Palæontological. He chose for his subject the first of these divisions, and spoke of the cells, the vascular tissue, the circulation and the growth of plants. Plants may be arranged under four heads: 1st, *Thallogens*, as the mushrooms, lichens and sea-weeds; 2d, *Acrogens*, consisting of ferns, lycopods, etc.; 3d, *Endogens*, or inside growers, as the grasses, corn and lilies, etc., but characterized in the tropics by the noble palms; 4th, *Exogens*, or outside growers, combining our trees, shrubs and most of the flowering plants. He concluded by speaking of the Cambium and Bass tissue, the latter of which constitutes the material used in the various textiles, and showed specimens which were obtained from the Roxbury waxwork, and the milk weed. He also alluded to the lactiferous vessels, which, however, are only found in some plants, and from them are derived India Rubber, Gutta Percha, etc. The most common with us are the milk weeds, celandine, and some of the composite plants.

Lizzie H. Smith, David Pingree Waters, John Henry Goldsmith, all of Salem, were elected Resident Members.

MONDAY, MARCH 30, 1868. — Regular Meeting.

Vice President GOODELL in the chair.

Donations and Correspondence announced.

Mr. HORACE MANN gave his fifth lecture on Botany. Subject: the leaf, its development, death and fall, sensitiveness, situation on the stem, etc., etc.

MONDAY, APRIL 6, 1868. — Regular Meeting.

Vice President GOODELL in the chair.

Mr. F. W. PUTNAM was elected Secretary pro tem.

Donations and correspondence announced.

The Secretary read by title a paper from EDWARD NORTON "on Mexican Ants," referred to the Publication Committee.

The CHAIR presented a Pitch-pipe in the name of SAMUEL DAY, and

remarked upon the value and rarity of the instrument, and gave an account of its history and use. The chair also read a note from JOHN H. SEARS, of Danvers, stating that several Hawks and Owls had commenced building their nests. The chair also called attention to several hymn and other books in possession of Capt. DAY, of Salem.

Mr. GEORGE L. VOSK of Paris, Me., was introduced and gave an account of the formation of glaciers. The following is a brief extract of his remarks :—

The existence of the glaciers depends upon the occurrence, in certain parts of the earth, of large masses of perpetual snow. The first question then to be answered, in the study of the glaciers in their physical aspect, is, what are the conditions under which snow lies upon the ground summer and winter, year after year; in fine, what is the cause of perpetual snow? In the common course of nature the water which falls from the clouds is disposed of in three ways: by sinking into the ground, by evaporating from the surface, and by flowing off from the higher to the lower lands in the form of rivers, by which it is carried to the sea; from the sea it is evaporated, to be condensed into rain and again thrown down upon the surface of the earth. But in order that this circulation may go on, the water must remain in the liquid form, — it must be water. Below a certain temperature water becomes ice, and whatever moisture falls from the clouds, falls not as rain, but as snow, or hail or ice. The higher regions of the atmosphere are in a great degree deprived of the solar heat reflected from the earth, and enjoy only the direct heat from the sun, which is not enough to keep water in the liquid form. What then becomes of the snow which falls upon high mountains, where it is so cold that it cannot melt, and thus cannot escape in any of the methods employed for the circulation of water? Why does it not accumulate indefinitely upwards until the whole country is buried in everlasting snow? This question is answered by the existence and operation of the glaciers. At its upper end a glacier is snow; this snow is very gradually compacted into an immense river of ice, which forced along by the subsiding and pressing out laterally of the great mass of unconsolidated snow at the upper end, moves at the rate of from one to two feet in a day, and thus draws the snow off in a solid form from a high cold region where it could never melt so as to soak into the ground, or evaporate, or flow off to the ocean, and leads it down to a low warm region where it melts, and giving birth to a stream of water finds its way to the ocean, thus completing the circulation of moisture above referred to.

It is at first sight difficult to understand how ice can move through a long winding valley over all the roughness of the ground. Prof. Tyndall, however, has shown that the hardest ice, under certain conditions, behaves as a plastic mass. He actually moulded cubes of brittle ice into rings, spheres and other figures. The requisite conditions are pressure and time; immense compression, applied in a very gradual manner, forces the huge mass of the glacier along the windings of the valley, around the mountain spurs; welds together several tributaries into a main trunk, and gives to the whole mass a motion of precisely the same quality, though far less in velocity, as that of a river of water.

The great weight of the moving ice produces an effect upon the rocks and the ground over which it passes, which is not only of inter-

est in connection with the existing glaciers of the Alps, but is extremely instructive in a geological point of view, inasmuch as a careful study of the geological action of the glaciers of the present time gives us the key by which to unlock a volume which has been a long time closed; enables us to restore a picture which has long since vanished; to see the world at a time when not only the whole northern part of Europe, but also of America, was covered with vast fields of ice, which grinding along, over the tops of the highest hills, gave the finishing touches to the surface geology, and left their history plainly recorded upon the solid rocks in the shape of a polishing and furrowing of the hardest materials, and show us also that nature uses the same means now to accomplish her results as she did ages upon ages ago, long before man had appeared upon the scene.

On motion of Mr. W. P. UPHAM the thanks of the Institute were tendered to Mr. Vose for his interesting communication.

MONDAY, APRIL 13, 1868. — Regular Meeting.

Vice President GOODELL in the chair.

Mr. F. W. PUTNAM appointed Secretary pro tem.

Donations and correspondence announced.

Mr. HORACE MANN delivered the sixth lecture of his course. Subject: the structure of the flower and the various methods of fertilization, especially that of the orchids by insects.

MONDAY, APRIL 20, 1868. — Regular Meeting.

Vice President GOODELL in the chair.

Mr. F. W. PUTNAM appointed Secretary pro tem.

Correspondence and donations announced.

Mr. PUTNAM stated that the collection of Fossils received from Prof. JAMES HALL, in exchange, was quite valuable, the specimens having been identified and named by Prof. Hall.

Mr. PUTNAM read a letter from Mr. S. JILLSON, giving an account of the nest containing the white eggs of the Tawny Thrush presented at the last meeting. The nest was found in June, 1867, and the bird was seen, leaving no doubt as to the species. Mr. Jillson also wrote that he had found pure white eggs of the Blue Bird.

Mr. BENJ. S. DODGE presented a stone implement found in Rowley. This implement combined characters of the axe and gouge with a groove for a withe by which a handle was probably attached. In this connection Mr. PUTNAM alluded to the different forms of stone implements that had been found in New England, and stated that he was having drawings of the various kinds in the collection made for the

purpose of publishing an illustrated catalogue, and that the Institute would be pleased to receive all the specimens obtainable in order to render the catalogue as complete as possible.

MONDAY, APRIL 27, 1868. — Regular Meeting.

ROBERT BROOKHOUSE, Esq., in the chair.

Correspondence and donations announced.

The hour of the meeting was occupied by Mr. HORACE MANN with the seventh lecture of his course. Subject: fertilization of ferns and allied plants.

J. W. Furbush of Salem was elected a Resident Member.

MONDAY, MAY 4, 1868. — Social Meeting at Hamilton Hall.

The leading object at this meeting was to present a collection of the common animals found on our seashore and in some of the ditches and ponds of the vicinity. Very few persons in any community are acquainted with the vast field of nature that is everywhere to be found wherever they may direct their steps. One of the most prolific places in our neighborhood for specimens of marine animals and plants, is around the piers of Beverly bridge, in the channel of the river, at low tide. A visit there would well repay any one, and even excite the wonder and admiration of the most indifferent observer at beholding the beautiful specimens and the great variety that are presented to his view. Several members of the Institute collected a goodly number and variety of animals and plants which were placed in a series of aquaria arranged on tables occupying three sides of the Hall.

The specimens were all duly labelled and from the cards we copy the following: Hermit crabs, sea anemones, crabs, lobsters, sponges, vorticellæ or cup animals, young jelly fishes, star fishes, sea urchins, muscles, sea snails, tom cods, hydroids, etc.; also, of those living in fresh water, were the caddis worms, leeches, perch, pout, three species of turtles, larvæ of insects, etc.

The meeting was called to order by Vice President GOODELL, who, after a few appropriate remarks, introduced Mr. E. S. MORSE, the lecturer of the evening. Mr. Morse gave a brief and very comprehensive description of the structure and habits of several of the species which were in the aquaria, directing his attention more especially to the mouths and the manner in which each derives its nourishment; also the mode in which the jelly fish is propagated, etc.

After the closing of Mr. Morse's address, an opportunity was afforded to examine the various objects in the different aquaria. The

minute forms of living animals and plants, sections of the spines of sea urchins, skin of the shark, scales of the flounder, etc., were placed under some dozen microscopes in charge of Mr. EDWIN BICKNELL, for the purpose of illustrating some points in the anatomical structure peculiar to these lower forms of animal life. Many of the above preparations were beautifully executed by Mr. Bicknell, who has acquired a well deserved reputation as a skilful preparator of slides for microscopical investigations.

There was also on the tables a Warzian case belonging to Mr. JOHN ROBINSON, containing a beautiful collection of growing ferns and other plants, which attracted much attention and added greatly to the interest of the exhibition.

After a sufficient time had been appropriated for the examination of the various specimens, the collation was announced, and while the company were paying their attention to this portion of the entertainment, the tables, aquaria, and microscopes were removed to the lower hall, where those who desired could devote more time to farther investigations.

MONDAY, MAY 11, 1868.—Regular Meeting.

Vice President GOODELL in the chair.

Correspondence and donations announced.

A communication was read from Mr. JOHN H. SEARS, of Danvers, on the return of the Birds.

Mr. D. B. HAGAR made some interesting remarks on ventilation, which he designated familiar talk. He proposed three questions:—first, what is bad air? second, where is bad air? third, how to get rid of bad air? The last is the most important practically, and various methods were suggested. The subject was illustrated by several very simple and appropriate experiments.

Discussion followed, participated in by Messrs. KIMBALL, HAGAR, and GOODELL.

A vote of thanks was passed, with the request that Mr. Hagar would give these remarks in a lecture, the next season, with such additions as may be suggested.

Edward Lane, S. Augusta Brown, and Laura S. Spiller, of Salem, were elected Resident Members.

WEDNESDAY, MAY 13, 1868.—Annual Meeting.

Vice President GOODELL in the chair.

Records of the last annual and regular meetings read.

The Annual Reports of several of the officers were read and accepted.

The SECRETARY, in his report, stated that the scientific collections, in conformity to a vote of the Institute passed at a special meeting held in May, 1867, have been deposited with the Trustees of the Peabody Academy of Science in the East India Marine Hall, and will be arranged with the Museum of the East India Marine Society in the new cases made for that purpose. The Museum thus arranged will constitute one of the finest in the country and in some of the departments will be unique.

The large room on the first floor of Plummer Hall formerly used for the Museum, is now arranged for newspapers, pamphlets, and those books not intended for circulation; the area in the centre will accommodate some two or three hundred persons, and is well adapted for the lectures and meetings of the Institute. The cases in the eastern ante-room on the same floor will accommodate the Manuscripts and Historical Collection. The western ante-room has been fitted with a gallery for the deposit of the Periodicals and other works received in exchange; also for the records and publications of the Society.

MEMBERS.—Eighty resident and three corresponding members have been elected during the year. Notices of the decease of twelve of the former and three of the latter have been received. Fourteen of the former have removed or retired. The present number is seven hundred and eighty-five;—five hundred and ninety-nine Resident, one hundred and eighty-six corresponding.

Biographical notices of the following deceased associates will be prepared for the *Historical Collections*:—Mary Doyle, died in Salem, July 16, 1867, aged seventy-one years, nine months and four days. N. A. Frye, died in Salem, January 5, 1868, aged fifty-two years, one month and eleven days. M. Hartney, died at Worcester, Wednesday, January 15, 1868. Henry S. Joselyn, died in Salem, January 26, 1868, aged forty-two. D. H. Johnson, died in Salem, February 14, 1868, aged sixty-four years, one month and two days. Edward D. Kimball, died in Paris, France, September 22, 1867, aged fifty-six. N. J. Kinsman, lost at sea. S. Mackintire, died at Salem, Wednesday morning, January 24, 1868, aged fifty-six years. Jeremiah Page, died at Salem, November 1, 1867, aged seventy-one years and five months. Francis Peabody, died at Salem, October 31, 1867, aged sixty-five years, ten months and twenty-four days. George F. Read, died in Salem, October 4, 1867, aged fifty-six years, eleven months and twenty-two days. W. S. Roberts, died October 21, 1867, aged sixty years. Joseph Torrey, died at Burlington, Tuesday, November 26, 1867, aged seventy years. J. A. Andrew died at Boston, Wednesday, October 30, 1867, aged forty-nine years. C. G. Page, died at Washington, D. C., May 5, 1868, aged fifty-six.

MEETINGS.—Five Field Meetings have been held during the past season. At Haverhill, July 2; at Andover, July 16; at Beverly Farms, August 1; at Kittery, Me., August 22; at Ipswich, October 4. They were very successful and largely attended, and at every place received the kind attentions of the citizens and a cordial welcome. The meeting at Kittery was the first one held beyond the limits of the State. Our thanks are due to the friends of the Institute in these several places, and to the directors, superintendents and other officers of the Eastern and Boston and Maine Railroads for the courtesies extended on these occasions.

The Quarterly and Regular Monday Meetings have been held during the wintry months as usual. Two Microscopic Meetings, of a social character, one on Monday evening, January 6, the other on Monday, May 4, were well attended and passed off very pleasantly.

LECTURES.—A course of seven lectures on Botany by Mr. Horace Mann of Cambridge, was delivered in Plummer Hall on alternate Monday evenings during the months of February, March and April. These lectures were repeated before the Boston Society of Natural History. Mr. Mann treated his subject in a very lucid manner and gave evidence of becoming one of our most instructive lecturers on the study of Botany.

Also a course of seven lectures in the Lyceum Hall: first, on Thursday, March 5, by Mr. E. S. Morse of Salem, on the different modes in which animals eat, commencing with the lowest forms among the radiates and tracing the gradual modifications which the organs of mastication assume in the several classes of the animal kingdom. Second, on Thursday, March 12, by Mr. M. G. Farmer of Salem, with experiments illustrating the various discoveries that have been made in Electricity, Electro-magnetism and the kindred subjects. Third and fourth by Capt. N. E. Atwood, of Provincetown, on Fishes and the Fisheries, on Thursday, March 19 and 26. Fifth, by A. C. Goodell, jr., Esq., of Salem, on the History of Church Music, Thursday, April 9. Sixth, by A. C. Goodell, jr., Esq., Thursday, April 16, on Church Psalmody and Hymnody previous to the present century. Seventh, by General H. K. Oliver, of Salem, Thursday, May 4, on Ancient Music. The last three lectures were interspersed with illustrations by an excellent choir and orchestra. Many of the old favorite fugues and other tunes were sung with great skill and excellent effect, and in the Coronation, St. Martin's and Federal Street, the whole audience were requested to join. The success of these musical lectures encourages the hope that similar lectures, with illustrations, may hereafter be acted upon by the Institute.

THE CORRESPONDENCE continues to increase in consequence of the more extended circulation of the different publications. The letters

have all been arranged into volumes and indexed so that they are accessible for reference.

THE PUBLICATIONS OF THE HISTORICAL COLLECTIONS and the PROCEEDINGS have been continued as in past years. They are well received by kindred societies with whom a system of exchange has been established. It is desirable that these should be maintained to a high standard, and to do so additional efforts should be made to provide suitable means for this desirable object.

THE HORTICULTURAL EXHIBITIONS were omitted the past season in consequence of the scarcity of fruit and the presumed uncertainty of having a display that would be creditable to the cultivators in this county.

THE TREASURER presented the following statement of the financial condition for the year ending May, 1868.

GENERAL ACCOUNT.

Debits.

Athenæum; Rent, half Fuel and Librarian	\$420 88
Publications, \$1265 07; Salaries, \$320 65; Gas, \$12	2097 72
Express, etc., \$172 05; Sundries, \$231 08	403 13
Two shares in Printing office, \$200; Social Meetings, \$298 36.	493 36
To Historical account	53 15
	<hr/>
	\$3468 24

Credits.

Balance of last year's account	\$29 92
Dividends of Webster Bank, \$45; Sundries, \$28 52	73 52
Field Meetings, \$36 95; Social Meetings, \$381; Lectures \$271 05	689 00
Peabody Academy of Science, services of Janitor, \$299 88	} 648 88
“ “ “ on account 250 00	
Salem Athenæum, for Janitor's services 94 00	
Donations:—F. Peabody, \$100; J. S. Cabot, \$50; J. Bertram, \$100; J. G. Felt, \$10; Adams & Richardson, \$11 13	271 13
Sale of Publications, \$631 74; Assessments, \$1028	1659 74
Natural History and Horticultural Account	6 80
Balance Account	95 80
	<hr/>
	\$3468 24

NATURAL HISTORY AND HORTICULTURE.

Debits.

Preservatives and Taxidermy	\$65 70
Deposit in Savings Bank	100 00
To General Account	6 80
	<hr/>
	\$172 00

Credits.

Lowell Bleachery dividend	\$160 00
Portland, Saco and Portsmouth Railroad	12 00
	<hr/>
	\$172 00

HISTORICAL ACCOUNT.

Debits.

Binding, \$108; Repairing, \$3 15 \$111 15

Credits.

Naumkeag Bank dividend	\$20 00
Michigan Central Railroad	38 00
From General Account	53 15
	<hr/>
	\$111 15

THE LIBRARIAN reported that the additions to the Library have been as follows:

Folios 20; Quartos 32	52
Octavos and Lesser fold	344
Pamphlets and Serials	2559

The above have been obtained, with few exceptions, by exchange with editors and kindred institutions, and by donations from members and friends. These contributions have been received from two hundred and twelve different individuals and institutions, and may be classed as follows:—Editors, nineteen; Societies, sixty-eight; others, one hundred and twenty-five. A portion of the Library, consisting of the newspapers, pamphlets and many of the books of reference, not intended for circulation, has been deposited in the lower hall, thus furnishing accommodations for a suitable arrangement of this department.

THE SUPERINTENDENT OF THE MUSEUM stated that arrangements are in progress for carrying out the details of the agreement for the deposit of the scientific collections with the Trustees of the Peabody Academy of Science, and having the same properly arranged in the East India Marine Hall, in connection with the Museum of the East India Marine Society. The rearrangement is a laborious undertaking and it will be some time before sufficient progress will have been made to have the same open to public inspection. Several important additions have been made during the past year, and have been duly noticed at the regular meetings. The receipts in the various departments may be classified as follows: twenty-seven donors have contributed eighty-nine specimens of Indian implements of stone and bone, and other Archæological and Ethnological specimens; ten, thirty-four in the department of Comparative Anatomy; thirteen, eighteen of Mammalia; twenty-seven, fifty-six of Birds; four, twenty-nine of Bird's nests and eggs; eleven, fifty-six of Reptiles; nine, about one thousand of Fishes; thirty-nine, about two thousand five hundred of Insects; six, fifteen of Crustacea; four, twenty of Worms; sixteen, about two thousand of Mollusks; twelve, one hundred and two of

Radiates; four, six of Sponges; six, thirteen Geological; eighteen, about one thousand eight hundred Fossils; seventeen, about ninety of Minerals; ten, fifty to the Herbarium. Thus nearly eight thousand specimens have been received in the Natural History department.

Some twenty donations have been made to the Museum of the Historical department, not including the manuscripts and books.

While the collections are in this transition state a farther report cannot readily be made.

The following OFFICERS were elected for the year ending May, 1869 :

President.

HENRY WHEATLAND.

Vice Presidents.

Of Natural History—S. P. FOWLER. *Of Horticulture*—WM. SUTTON.
Of History—ABNER C. GOODELL, JR.

Recording and Home Secretary.

A. H. JOHNSON.

Foreign Secretary.

A. S. PACKARD, JR.

Librarian.

ALPHEUS HYATT.

Superintendent of the Museum.

F. W. PUTNAM.

Finance Committee.

J. C. Lee, R. S. Rogers, G. D. Phippen, James Upton, S. Endicott Peabody, Robert Brookhouse.

Lecture Committee.

James Kimball, A. C. Goodell, jr., Wm. C. Endicott, George Perkins, G. D. Phippen, E. S. Morse.

Field Meeting Committee.

G. B. Loring, Samuel P. Fowler, C. M. Tracy, E. N. Walton, Charles Davis, A. W. Dodge, J. R. Nichols, H. C. Perkins.

Publication Committee.

A. C. Goodell, jr., William P. Upham, F. W. Putnam, C. M. Tracy, R. S. Rantoul, A. S. Packard, jr., E. S. Morse, Alpheus Hyatt.

Library Committee.

J. G. Waters, Alpheus Crosby, James Chamberlain, Henry J. Cross.

Curators of Historical Department.

W. P. Upham, Henry M. Brooks, M. A. Stickney, John Robinson, R. S. Rantoul, W. S. Messervy, James A. Gillis.

Curators of Natural History Department.

H. F. King, G. A. Perkins, C. M. Tracy, James H. Emerton, Caleb Cooke, G. Peabody Russell, Edwin Bicknell, E. S. Morse, Alpheus Hyatt, A. S. Packard, jr., Benjamin Webb, jr.

Curators of Department of Horticulture.

John M. Ives, J. S. Cabot, R. S. Rogers, G. B. Loring, John Bertram, S. A. Merrill, Wm. Maloon, Andrew Lackey, G. F. Brown, C. H. Higbee, E. S. Rogers, John F. Allen, Francis Putnam, Wm. Mack, B. A. West, G. D. Glover, A. W. Dodge.

Voted, That the election of Treasurer be deferred, and that the Treasurer of the preceding year be requested to act until a successor shall be chosen.

The following amendments to the By-laws were adopted :

CHAPTER II. To be added to first paragraph (of President) "He shall be *ex-officio* a member of all Standing Committees."

Third paragraph, before the word "Secretary" insert "Recording and Home."

The following to be added as a new paragraph :

"The Foreign Secretary shall have charge of the Foreign Correspondence and Foreign Exchanges of the Publications of the Institute."

CHAPTER III. The three first sections to be expunged.

George Wheatland, jr., of Salem, and Mary E. Breed of Lynn, were elected Resident Members.

MONDAY, JUNE 1, 1868. — Adjournment of Annual Meeting.

President in the chair.

Records of last Meeting read.

Donations and correspondence announced.

Mr. W. P. UPHAM presented a coin, in the name of Mr. E. G. JOHNSON, and read the following account of the same prepared by Mr. M. A. Stickney.

"It is a double Tournols of Louis XIII, 1639, found near the Salem Horse Railroad Office, near the tunnel, in excavating for the new aqueduct in 1868. This piece was coined at Tournage, France, and was, at that time (1639), of double the value of one of the earliest French coins called the Denier, from the Latin Denarius, a silver piece of the value of a penny and which at that time had decreased so much as to be represented in copper."

Mr. UPHAM stated that the coin was probably used and lost near the time of the coinage by one of the early French settlers.

After the transaction of some general business the meeting adjourned.

THURSDAY, JUNE 11, 1868.—Field Meeting at Saugus.

This day a small but zealous representation of the members of the Institute met at the Eastern Railroad station, according to appointment, at 10 A.M., to start for Saugus to hold the first Field Meeting of the present year. A lowering sky strongly hinted the propriety of a postponement, but with unextinguished ardor the happy few took the train for the field.

Arrived at Saugus they were conducted to the Town Hall, where Mr. WILBUR F. NEWHALL and others gave information concerning the various places of interest in the town, and proffered guides to any parties that might be formed to visit them. Several parties were formed and succeeded in making their chosen tours, and in returning to the Hall before it rained. This was a matter for general congratulation, which heightened into unusual satisfaction when it was found that the objects of the different excursionists had been, for the most part, attained and that the friends had, with much liberality, provided for the hospitable entertainment of their visitors in welcome additions to the usual collation.

One party had an opportunity to visit Dungeon Rock, where Mr. Hiram Marble and his son are still engaged, under the direction of clairvoyants, in searching for the traditional Pirate's Cave and hidden treasure, said to have been buried by the great earthquake of 1668. The story of the pirate's retreat and fate, for which there is no recorded authority older than that of the late Alonzo Lewis, in his history of Lynn, is too familiar to need repetition here. Those who wish to peruse the story in full can consult Mr. James R. Newhall's valuable edition of Lewis' History of Lynn, which is greatly enriched by the editor's additions and comments.

The elder Marble was not at home on Thursday, but his son did the honors of the Dungeon Rock very acceptably. The excavation which they have made in the solid rock extends along an irregular opening into the bowels of the earth, some two hundred feet, more or less, when lighted by lanterns at suitable intervals, admitting of a not difficult passage, to any one who wishes to explore its recesses, upon the payment of an admission fee of fifteen cents. They have been engaged seventeen years in their labors and their patience is not yet exhausted. Their blasting processes are only carried on in the winter, when they expend the funds they receive from visitors in the summer, the direction being determined by the instructions conveyed through the spiritual mediums consulted by them. The spot is very romantic and picturesque, and well worth a visit, aside from any traditional interest with which it is supposed to be invested. There is a good road to the foot of the hill, if you only succeed in finding the right one, and the view from the summit of the rock is extensive and beautiful. Several portraits, photographs, drawings and relics, are shown, and a

pamphlet, purporting to be a (spiritual) history of the place and its former occupants, as well as some of the photographs, can be purchased for a suitable consideration. The visitor may believe as much or as little of what he reads and hears as his credulity will allow, but he cannot fail to be interested during the time spent there, and charmed with the wild and romantic beauty of the scenery, and the extensive panorama spread out before him.

At the hour appointed for the addresses and discussions the hall was well filled by an auditory consisting largely of the residents of Saugus.

The meeting was called to order at 2.45 P.M. by the **PRESIDENT**.

Records of the last meeting read; donations and correspondence announced.

The President called upon **WILBUR F. NEWHALL, Esq.**, to give some information concerning places of interest in Saugus.

Mr. Newhall accordingly entered upon an interesting narrative, in the course of which he stated that the first foundry in this country was established at Saugus by Joseph Jenks, in the years 1643-4. A company was first chartered in London, and Joseph Jenks, who was a skilled workman, and a man of inventive genius, conducted its business successfully. There remains a bank of cinders extending from the foundry to the mill-pond marking the extent of the business. The ore was smelted from what is commonly called bog-ore, taken from a neighboring meadow. The foundry produced from eight to ten tons of iron per week. The first casting is said to be an iron pot, now or recently in the possession of the family of the late Alonzo Lewis, the historian of Lynn. Mr. Lewis, we believe, was a descendant of this Joseph Jenks. The present dam is fifteen feet lower than the old dam. At first a dam was built this side of the present, but finding an insufficiency of water they built farther down the stream. Joseph Jenks continued the foundry business for over forty years.

He made the first dies for coining money in the colony, which consisted of the pine-tree shilling, and six and three penny pieces, bearing the date of 1652. These are highly valued by the coin collectors of the present day. Other inventions, which were highly esteemed by the colonists of that early period, are attributed to him.

[A son of Mr. Joseph Jenks, jr., who was born in England, came to this country a few years after his father, worked for some time in Lynn, then removed to Pawtucket, R. I., where he built a forge, the first in that colony, which was destroyed in King Philip's war. He lived to a good old age and was highly esteemed. Some of his descendants, in the second and third generation, were persons of note; one of them for five years occupied the Gubernatorial chair. The late Elias Jenks, of Salem, a noted shipbuilder some thirty years since in this city, was a descendant, and was born in Rhode Island. He came to Salem when a young man, and possessed many of the traits of character, especially the mechanical genius, of the emigrant ancestor.]

Mr. Newhall also alluded very appropriately to some of the changes that had taken place since the meeting of the Institute at Saugus in 1859, and spoke of several persons interested in that meeting, who have since been enrolled among the departed worthies of that ancient town.

Mr. F. W. PUTNAM of Salem, exhibited several zoölogical specimens found during his rambles, such as the eggs of the wood turtle, several species of frogs, dor-bugs, etc., etc. In answer to inquiries which were made, he gave some highly interesting information concerning the habits of the specimens exhibited, and also spoke of the damage done to vegetation by insects, alluding to the ravages of the canker worm for several years, and its apparent disappearance the present season in several localities where it had been very abundant for a few preceding years. This he accounted for by the parasitic insects which feed upon the worm and consequently check its increase for a time.

The PRESIDENT remarked that the present season has been very favorable to all vegetation; the fields never looked greener than at this time; the specimens of flowers were abundant and looked finely. Flora appears to be in the ascendant. The collections of botanical specimens were very large. He called upon Mr. C. M. TRACY of Lynn, who greatly instructed the audience with his comments upon many of the plants and flowers, taking up the several species and narrating the peculiarities of each.

Mr. S. P. FOWLER of Danvers, being called upon, said that he wished to speak of the value of old books and papers, "just the stuff we make history of," and offered a vote of thanks to Mrs. Jonathan Newhall, of Saugus (who had that day presented several old volumes to the Library of the Institute) which was unanimously adopted.

Mr. A. C. GOODELL, jr., of Salem, spoke of the historical reminiscences, and detailed his visit to an old house which was undoubtedly built by one of the early workers at the foundry. He mentioned several interesting facts in connection with the iron works; also of the coining of money in the colonies; and commented upon the appropriate names given by the early colonists to several places in this vicinity. Thus, Brooksby was applied to what is now Peabody, being the place where several brooks were united; Hammersmith, to that part of Saugus near the old foundry, etc. Mr. Goodell, in graceful and fitting terms, spoke of Saugus as a favorable region for the Field Meeting of the Institute. Being at the junction of the fresh and salt water, it furnished specimens for the zoölogist. Its fields were fruitful to the botanist; its geological opportunities were excellent and it was an interesting historical region. Two hundred and twenty years ago the sound of the trip hammer ranged through these fields and

hills, and the work and name of Joseph Jenks filled no mean place in New England history. Mr. Goodell exhibited some pieces of iron which he found at the bank of cinders near the mill-pond, presumed to be fragments of castings from the old furnace.

Mr. W. F. NEWHALL followed Mr. Goodell and gave some additional facts about the "old house."

Mr. ALPHEUS HYATT, in response to a call from the President, reported that he had made an unsuccessful search for polyzoa. The species for which he was in quest being nomadic and capricious in their habits of life, he had, as often before, returned without them. A specimen of horse-tail rush upon the table led him to offer some interesting remarks upon the ancient vegetation of which this was a representative.

Mr. C. M. TRACY had examined the specimens of Iron presented by Mr. Goodell, and having had some practical knowledge of founding iron, was able to identify them as the sprue formed upon all castings, by the hole in the mould through which the molten iron is poured. This is broken off when the mould is opened and thrown away.

Mr. E. N. WALTON of Salem, spoke of the pleasure it gave him to come once more to this favorite spot, and especially of his interest in the beautiful river running through and bearing the name of the town. He had often visited the source of the river, where at South Reading it starts from the lake in that town, a modest brook, and then flows on through Lynnfield forming for some distance the boundary line between that town and South Reading, acquiring strength from springs and numerous little streams, occasionally furnishing motive power for manufacturing establishments, and here, at the point of joining the tide water of the ocean, it gives life to the woolen mill where so many of the party had to-day witnessed the transformation of wool into flannel while the proprietor had kindly explained the successive processes of the manufacture.

Mr. W. alluded to the large number of children present at the meeting, and took occasion to speak of the value of object teaching, and was glad to learn that the excellent school teachers of the town had adopted this most efficient method of imparting instruction. Botanical text books were rendered immeasurably more valuable by practical illustrations and personal examination of the objects treated of. A better idea of geology could be planted and retained in the mind, by a single Field Meeting experience, than by weeks' of weary study of dry technicalities. And the principle holds good indefinitely as we take up one science after another. In addition to the intellectual advantages to be derived from the Field Meeting, the physical benefit arising from an occasional day of health-giving ramble in wood and dell, creating new life and vigor, could not be over estimated.

Mr. PUTNAM spoke of the interest now felt in the collection of relics

of the Indian race, and urged the importance of preserving such arrowheads and stone implements as may have been or may hereafter be found, and depositing them in the cabinets of the Institute.

Business of the Institute being in order, on motion of Mr. PUTNAM, a committee was chosen to take into consideration the subject of inviting the "American Association for the Advancement of Science" to hold its meeting of 1869 in Salem, and to have full power to act and make the necessary arrangements.

Mr. GOODELL read a letter from Pittsfield inviting the Essex Institute to hold a Field Meeting with the Natural History Society in that place during the present season. Action on this motion was reserved for a future occasion.

After some discussion of other incidental topics, and the transaction of miscellaneous business, the Institute adjourned, having first adopted, with entire unanimity and cordiality, the following vote of thanks, offered by Mr. TRACY.

Resolved, That the thanks of the Institute are hereby most sincerely presented to our friends in Saugus, who have furnished the various pleasant and comfortable features of this day's entertainment, including Messrs. J. D. Lawrence, A. A. Scott, E. P. Robinson, Everett E. Wilson, Wm. Stocker and Wilbur F. Newhall, for their exertions in our behalf; also, to Mrs. John Armitage, Mrs. Benjamin Parker, Mrs. E. P. Robinson, Mrs. Tyler, Mrs. Follett, and other ladies, for their very kind attentions; also, to the Selectmen of Saugus for the use of the Town Hall, and to all others, who, although not known to us, have helped to make this meeting so agreeable.

FRIDAY, JUNE 12, 1868. — Adjourned Meeting.

President in the chair.

S. Augustus Shatswell, G. B. Hall, N. T. Snell, Eliza G. Cogswell, Sarah A. Lynde, all of Salem, were chosen Resident Members.

MONDAY, JUNE 15, 1868. — Regular Meeting.

President in the chair.

William B. Allen, James R. Chapman and Charles A. Larrabee, of Beverly; Edward A. Lord and L. H. P. Turner, of Danvers; Andrew A. Scott, and James Niven, of Saugus, were duly elected Resident Members.

WEDNESDAY, JULY 1, 1868. — Field Meeting at Essex.

Those members and friends of the Institute from Salem, who attended the meeting went, with a few exceptions, in two parties. One, and that much the largest, left Salem at 8, the other at 11.15 A.M.

The route chosen was by cars to Manchester, and thence by vehicles, four and a half miles, over a pleasant road through the woods to Essex. These woods, famous as they are for former contributions to the herbaria of eminent botanists, tempted the lovers of flora among the pedestrians to turn frequently from the path to gather specimens.

Those who rode directly to the appointed town, set out on their explorations in different directions. Some to visit the antiquarian relics of this old settlement. The old burying ground is a curious place and the visitor will be likely to pause at the tablet which marks the resting place of Rev. John Wise the first minister. There are other stones more than a century old, and one which "perpetuates the singular virtues of Rev. John Cleaveland, who died April 22, 1799, which day completed his seventy-seventh year."

From the belfry of the North Church a fine view may be had, including nearly all parts of the town. The bell in this steeple bears the mark "Revere, Boston, 1797."

The vestry of the First Church, kindly granted by the society, was used as the common rendezvous. At this place a committee of ladies, members of the Institute, took charge of the lunch baskets out of which they spread the usual pic-nic repast, after which the assembled company removed to the North Church to hold the customary meetings for reports and discussions.

At 2.25 P.M., the meeting was called to order by the President. Records of last meeting read. Donations and correspondence announced.

THE PRESIDENT introduced the literary exercises of the meeting by remarking that ten years ago the Institute held a Field Meeting at Essex; a meeting of marked interest, greatly enjoyed by those who participated, and which had left pleasant memories of the hospitality of the Essex people. The history of Essex well repaid examination. It was set off from Ipswich in 1679 as a separate parish and called Chebacco Parish. The setting off of the new parish gave rise to troubles similar to those very generally experienced in those times, when such divisions occurred. Chebacco Parish was incorporated as the town of Essex in 1819. Salem had furnished two ministers to Essex. Theophilus Pickering, son of John and Sarah (Burrill) Pickering, of Salem, a graduate of Harvard College in 1719; in 1725, on account of the sickness of Rev. John Wise, was invited to assist him. He was ordained and settled over the Chebacco Church in October, 1737, and until the year 1742 labored harmoniously among the people. About this time Whitfield's preaching occasioned extensive revivals and church controversies and division, in which Mr. Pickering and his people shared. He died in 1747.

Rev. Robert Crowell, son of Captain Samuel and Lydia Crowell, of

Salem, a graduate of Dartmouth College, in 1811, was settled in Essex in 1814. Among other valuable services rendered to the town he wrote a history of Essex printed in 1853, which his son, Prof. E. P. Crowell of Amherst College, is about to supplement and republish.*

The President remarked that at the previous meeting in Essex, the members of the Institute were much instructed by remarks from Hon. David Choate, who is present on this occasion and could interest us still farther by giving information concerning this town and its inhabitants.

Thus called upon, Mr. CHOATE in thoughtful and sprightly terms addressed the meeting.

He said that in ten years a town ought to have made progress, but he feared their visitors to-day could not see the signs of life and growth they have been wont to notice in many of the towns in Essex County which they had recently visited; they were on the line of railroads, but Essex was too remote from these facilities of communication. Here we should see the same river, the same vessels built and sent to the same market; yet he thought there were some things in their natural history of interest. He believed in the existence of rich deposits of iron from the fact that in certain localities the magnetic needle was more deflected than by the mines considered so valuable at Canaan Mt., in Connecticut. There are also natural paint mines, although at present unwrought.

At the former meeting much was said concerning various specimens belonging to natural history, but he did not remember that anything was said about the people. There was a great deal to be said concerning the early settlers of Essex, then the Agawam or ancient Chebacco district, which the present generation should keep in remembrance. When the records of the last Field Meeting of the Institute were read, he realized that we were doing a good work in keeping fresh and present the useful facts of the past, and in instructing the communities we visited, especially the younger members of them concerning their local history.

Our people have had an opportunity to show their patriotism in the late war, and twenty-four of our citizens gave up their lives in the country's cause. Essex furnished one hundred and ninety-five men for the war, of whom one hundred and forty-three were her own citizens. Most of the twenty-four who gave up their lives were shot down on the battle-field. Since the last Field Meeting here we have had a railroad chartered, this being the third. It was chartered two years ago; and he humorously alluded to a threat he had received

*This book was published in the latter part of the year 1868, with sketches of the soldiers in the war of the rebellion, by Hon. David Choate, 1 vol., 8vo, pages 488. Essex, 1868.

that there should be an injunction to stop the operations, in the name of the Commonwealth, unless a report was made. In the name of the town officers he thanked the Institute for this visit. He said there was a veil between us and the past which he hoped this learned society would help to lift. He eulogized the Rev. John Wise, the first minister, whose resting place was visited with interest, both by politicians and ministers. He said by politicians, because the doctrine of no taxation without representation was first uttered by the man who sleeps in the tomb of John Wise. Mr. Wise took an interest in our young country. The first training in old Chebacco was in 1688, and John Wise was there, and here the military character of old Chebacco began. In this connection he told the story of the Essex boy, who having come across the cubs of a bear was finally pursued by the old bear herself but killed her by thrusting a pine knot into her open mouth—an act which showed the courage to which he had been trained, Mr. Wise having had a large influence in the training.

Mr. Choate also exhibited a copy of an old Genevan bible, printed in 1579, which was brought over by Capt. John Low and has remained in the family ever since. It was translated by Miles Coverdale, aided by John Rogers the martyr, and was printed over sixty years before the first cup of coffee was used in England, and eighty-seven years before the first cup of tea. There have been twelve crowned heads in England, down to Victoria, since the book was printed. He also exhibited a long cane with ivory head and silver mounted, which is said to have been made in 1578, a year before the book was printed. This also had been in the family of Lows, and it derived additional interest from the fact that the venerable Daniel Low had leaned upon it. It bore the inscription, engraved upon the silver, "Owned by the family in England, about 1578;" and above, "D. L., U. S. of America, Mch. 14, 1803."

Mr. GEORGE D. PHIPPEN, of Salem, was next introduced, and he described the region of the Essex woods where Dr. Cutler had rambled, led by the scent of the magnolia, as had the learned Oakes, the genial Nichols and Osgood, with whom several of us have made excursions. He then exhibited and described some of the specimens of flowering plants which had been collected, among which were the *Linnaea borealis*, named for the distinguished botanist, Linnaeus; *Diervilla Canadensis*, belonging to the same family; *Medeola Virginica*, or cucumber plant; *Viburnum*, several species; *Prinos glabra*, or inkberry; *Cypripedium acaule*; *Mitchella repens*, or loveberry, having always two blossoms to one fruit; *Lysimachia quadrifolia*, having four leaves around the stem, some varieties having more; *Pyrola rotundifolia*, or round leaved pyrola; several forms of the *Potentilla*, the *Kalmia*, etc. He also exhibited specimens of the holly and heath

families, concluding by speaking of the part which flowers bear in propagating the plant, and of the influence of insects, such as bees, in stirring up and distributing the pollen. If by this partial account of a few specimens he had succeeded in exciting in the minds of some of his young auditors wonder, he hoped they would investigate these subjects still farther, for wonder was only the shadow of the temple of knowledge.

Mr. EDWARD S. MORSE of Salem, described the shellheaps found in this vicinity, and which, in fact, have been found all along the coast away to Labrador. These deposits of clams and oyster shells were very ancient, and are to be taken as among the evidences of art which mark the period when they were deposited. There are but few stone implements found with these shells, and the evidence is that the shellheaps belong to an earlier period than the stone implements. Some of the latter he described, including the gouges. Some of the banks of oyster shells are twelve, fifteen and even twenty feet deep, indicating great antiquity. In Ipswich had been found the bones of the moose, deer, elk, and other animals.

Mr. F. W. PUTNAM of Salem, calling attention to the fact that the shellheaps probably belong to an earlier time than the stone period, said he had paid some attention to the stone period. The stone relics are similar in character even when found in different parts of the world; going to show that capacity is similarly developed everywhere.

He exhibited several specimens which had been presented, including a jasper spear head and a gouge from Mr. NOAH STORY of Essex, and a stone war club from Mr. J. S. DODGE of Beverly, who found it at Lynn. He described the instruments of the ancient Peruvians, and spoke of the way of indicating the uses of these various relics, which is largely a matter of conjecture. A hint concerning the uses of these implements is gained from examining those in use among the South Sea Islanders. The Institute is trying to perfect its collections of these curiosities and he appealed to the Essex people to bring out such specimens as they might have in their garrets or out of the way places. Each specimen will be duly figured, and labelled with the name of the donor. It is important to obtain a large collection of these implements that we might if possible learn from them concerning the migration of tribes. He concluded by calling attention to "The American Naturalist," which has now about two thousand subscribers, but must have one thousand more in order to pay its expenses.

Rev. EDWARD S. ATWOOD of Salem, in response to a call from the chair addressed the meeting, giving some interesting facts about the edition of the old bible which had been exhibited. This Geneva book, though old, is not uncommon. The first two editions of the

bible were in manuscript, and, though some of us may have a poor opinion of cards, it was nevertheless to the first printing of cards that the first printed specimens of the Scriptures were due. He then described the invention of cards with their various characters for the amusement of a French king. These were at first painted, but afterwards, as their use became common, the idea was conceived of printing them from blocks of wood. From this suggestion, detached verses and extracts from the bible were put forth, on yellow paper, in a similar manner, and in this fragmentary way we have the first printed specimens of the bible. This edition before us was printed in Geneva for the use of the English exiles banished there. Christopher Barker was made the sole printer of it. He thus became very rich and was made a Baronet. Mr. Atwood also spoke of the exquisite and clear printing which these ancient books reveal, many of them not being surpassed by the best printing of the present day.

Mr. ALPHEUS HYATT had again sought for polyzoa with but small success. He had found one interesting animal upon a piece of seaweed, which he exhibited in a small phial. It was one of the Tubulifera, a compound animal, originally a single cell; by a budding and branching growth it gains at last a common body, out of which and upon which many animals grow having an individual life. He described the minute anatomy of these animals, calling especial attention to the recently proven fact of the branching of the nervous system from the common origin, through the common body to all the members of the composite animal.

Mr. F. W. PUTNAM exhibited a specimen of stone with a tuft of hair attached, which had been sent in for explanation; and called upon Mr. E. S. MORSE to explain it. Mr. MORSE then described the process by which the muscle adheres to the rocks by throwing out minute hairs which it spins itself. These brown hairs on the specimen before us, though having the appearance of being human are not human, but are really formed in this way.

On motion of Mr. CHARLES DAVIS of Beverly, it was

Voted, That the thanks of the Essex Institute be tendered to the committee of the First Parish Church and the committee of the Universalist Church, for the use of their respective houses of worship for our meetings this day. Also to Norman Story, Ed. Lander, Leavitt Burnham, John S. Burnham, Dr. Hall, Daniel W. Bartlett, Grover Dodge, Horace Burnham, Leonard Burnham, Caleb Burnham and others for attentions and hospitalities shown us this day.

SATURDAY, JULY 18, 1868. — Special Meeting.

The President in the chair.

A Special Meeting was held this day, in Plummer Hall, at 3 P.M., to listen to the reading of a memoir, prepared by Hon. CHARLES W.

UPHAM of Salem, at the request of the Institute, on the life and character of its late President, FRANCIS PEABODY.

The services were opened by the President with the following brief remarks :—

We are assembled this afternoon to listen to the reading of a memoir prepared by Hon. Charles W. Upham at the request of the Institute on the life and character of our late President, FRANCIS PEABODY. He was from the beginning a constant friend of this Institution, and for the last two and a half years the president. In his last effort for the cause of science in this community he was only permitted to take a few of the initiatory steps, leaving the furtherance of the plans to be accomplished by the surviving associates in the trust, or by his or their successors.

On occasions of this nature the mind involuntarily runs back into the past and calls to recollection those who have in their day and generation been instrumental in the moulding of the various institutions which have for their objects the amelioration of man.

Some one hundred and ten years since at a meeting of the Monday Evening Club composed of the leading spirits of that day, the Brownes, Pickmans, Ornes, Higginson, Lyndes and Olivers, the plan of organizing the Social Library was matured. Some twenty years later the Philosophical Library was called into existence by Holyoke, Prince, Barnard and Orne of Salem, Willard and Fisher of Beverly, and Cutler of the Hamlet, now Hamilton. Thirty years pass away and we behold Bowditch, Story, Pickering, Silsbee and Putnam, organizing the Athenæum, taking the two libraries above named, as the basis of the new Institution. Ten years later, White, Tucker, Saltonstall, King and Ward are interested in the formation of an historical society, to preserve the rich materials everywhere then abundant to elucidate the history of this section of our good old Commonwealth. Another decade of years pass, Peabody, Webb, Cole, Phillips and Peirson are preparing courses of lectures on literature and science adapted to the popular mind, and hence arose that system of lectures which has been so prevalent throughout the country for the past thirty or forty years and which has been a great auxiliary to the cause of general education. After the lapse of some three or four years Nichols of Danvers, Oakes of Ipswich, Perry of Bradford, Page and Ives of Salem, laid the groundwork for a society of natural history to develop a taste for this study and to extend researches into the various departments of nature.

In this connection let us allude to the labors of Hodges, Lambert, Carpenter, Osgood, Crowninshield, Nichols and others in organizing the East India Marine Society in 1799, and consequent thereupon the forming of the valuable Museum which has had a world renowned reputation, and which, with the scientific collections of this society, is being rearranged in the East India Marine Hall, recently obtained and fitted up with galleries and cases for their reception through the liberality of a son of Essex, whom governments and crowned heads delight to honor.

Some of the above named persons were interested in several of these institutions; thus, for instance, the venerable Dr. Edward Augustus Holyoke was one of the original members of the Social Library in 1760, and at the time of his death in 1829, was president of the Athenæum and also of the Historical Society, having held that office

in both of these institutions from their respective organizations, thus taking an active part in the institutions of this place for a period of seventy years.

These have all passed away, leaving deep traces of their influence upon the institutions of this day, which are modifications of the preceding to conform to the wants and requirements of the age.

Although much has been accomplished, yet we have only entered upon the threshold of the domain of science. More remains to be done before the objects which these pioneers have labored for, can be said to be in a good working condition. This duty is never finished; the more an institution does the wider the vista opens and a greater amount of labor is found necessary to be done, increasing as it progresses in a geometrical ratio. It is a law of nature when any institution or organic object ceases to grow, decay commences and a gradual dissolution follows.

Let all who revere the memory of the departed and desire to have accomplished, or at least greatly advanced, the objects that were dear to them, come forward and extend a helping hand to those who bear the heat and burden of the day. Though dead they yet speak in the recollection of their zeal and energy in all worthy undertakings; truly their good works follow them.

Allow me to introduce Mr. UPHAM, who will give a graphic account of the untiring devotion of our deceased friend to the study of the sciences and their application to the useful arts, and a delineation of his character in the various relations of life.

Mr. UPHAM then proceeded to the delivery of his Memoir.*

Preceding the personal narrative was a very full and interesting exposition of the influences that made the Society, and the subject of the eulogy; what they have been, and brought him into the relation he sustained, as their chosen leader and head.

Glancing briefly at the influence of the presence of persons of marked impressiveness of mental traits among the first settlers, Mr. Upham traced the origin of the Institute directly to the Social Evening Club, designed to promote literature and philosophy, which was in existence in Salem about the middle of the last century, and by which a taste for literature and knowledge, a zeal in the prosecution of scientific studies, was imparted to the community, of which we can distinctly trace the imprints and monuments through all our subsequent history.

Filling up this sketch, with a fulness and accuracy of detail which perhaps no other person in our community is competent to supply, Mr. Upham passed on to the biography of Col. Peabody, dwelling on his strongly marked characteristics, his early love for and acquisitions in science, his agency in establishing and strengthening institutions of learning, and his many-sided attainments and activities.

At the close of the address, Hon. ASAHEL HUNTINGTON expressed

* This Memoir has been printed in the Historical Collections of the Essex Institute, vol. ix.

the grateful appreciation by the audience of its great interest and value, and moved its reference to the appropriate committee of the Institute, for publication. This motion was seconded by Vice President A. C. GOODSELL, jr., and unanimously adopted, and the company dispersed without farther formality.

The Trustees of the "Peabody Academy of Science," of which Mr. Peabody was chairman at the time of his decease, met in the forenoon for organization under the Act of the Legislature, and were present at Plummer Hall, in the afternoon, to listen to Mr. Upham's discourse.

WEDNESDAY, JULY 22, 1868. — Field Meeting at Rowley.

The third Field Meeting of the present season was held by the Institute at Rowley.

A dredging party consisting of six officers of the Institute left Salem the morning previous. They were hospitably welcomed and entertained by Messrs. Brookhouse, Ives, Johnson, Kinsman, and Frye, of Salem, at their camp house on Rowley river. This party spent the afternoon and evening of Tuesday in searching the shores and creeks of Rowley river, and in dredging near the mouth of Plum Island river. They continued explorations during the forenoon of Wednesday. The region proved to be, for the most part, too sandy to be very fruitful in specimens.

By the five minutes past eight train on Wednesday morning, members and friends of the Institute, a party numbering about one hundred and fifty persons, left Salem for Rowley; their number was enlarged by some who came by the quarter past eleven, and others who took the one o'clock train from Salem.

The residents at Rowley generously provided for the comfort of their visitors. They furnished carriages free of charge to take all who did not prefer to walk to the appointed rendezvous, a mile and a half distant.

Rev. JOHN PIKE, D.D., met those who arrived by the first train at the Town Hall, and in behalf of his fellow citizens, in a neatly turned address, welcomed the Institute to their town. He at the same time pointed out the various places and objects of interest, and tendered the services of guides who were waiting to lead parties wherever they might wish to go.

Several parties were formed and went in various directions over the town. At the appointed hour all assembled again at the Town Hall to partake of the collation prepared by a committee of ladies from the contents of the numerous baskets. Here substantial additions to the usual plain repast, and the presence of the Rowley Brass Band to en-

ertain the company with fine music, gave still farther proof of the cordial hospitality of the citizens.

After the collation the Institute assembled for their discussions in the Congregational Church. Previous to the opening of the meeting they were cheered with music by the band.

The meeting was called to order by the **PRESIDENT** at half-past two o'clock.

The records of the last meeting were read by the Secretary. **Mr. ALPHEUS HYATT** announced the donations to the library. Since the last meeting there had been forty-four donors; among whom deserving a particular notice was **Mrs. GEORGE CHOATE** of Salem, whose gift of books and pamphlets was large and valuable.

Mr. F. W. PUTNAM announced donations to the cabinets.

The usual announcement of the recent correspondence was deferred until the next meeting.

The **PRESIDENT**, in a brief introductory address, stated that this was the second Field Meeting held by the Institute at Rowley: the first was held in 1862. He called attention to the antiquity of the town, saying that during the period of early emigration to America, extending from 1620 to 1640, four thousand families, representing about twenty thousand persons, came to these shores. Near the close of this period in 1638 Ezekiel Rogers with sixty families arrived, and in April, 1639, commenced the settlement of Rowley. Among these early settlers were many clergymen and persons of eminent learning, and celebrated scholars. The early boundaries of the town included the sea-coast between Ipswich and Newbury, and extended from the ocean to the Merrimac river, embracing the present towns of Rowley, Georgetown, Boxford, Bradford and Groveland. The streets were from the first laid out so that each house might adjoin or be near to a brook. They remain but little changed to the present time.

In concluding, the President called upon **Mr. F. W. PUTNAM** to give an account of the specimens secured by the dredging party. **Mr. Putnam** exhibited specimens of the hydroid form of the jelly fish, and remarked on the law of alternate generation. The egg of this animal, furnished with cilia, moves through the water until it becomes attached to some stone or sea plant, when it commences a growth resembling a thickly branching sea-weed. After a time the branches bud, and these buds develop into minute animals, furnished with cilia and tentacles by which they obtain their necessary food. Having attained to a sufficient development, the Medusa buds sever their connection with the parent growth, and assume an independent life as the well known jelly fish.

He also exhibited a large collection of hermit crabs, sticklebacks, minnows, two species of star-fish, and specimens of polyzoa.

In compliance with a special request, Mr. Putnam discoursed upon the "Greenhead." So numerous are these flies upon the Ipswich and Rowley marshes, so bloodthirsty their disposition, so fierce their onset, so unforeseen and overwhelming their attacks, that the citizens of Rowley listened feelingly to a minute description of the green eyes, of the bodily structure, and especially of the lance and blood-sucking tube with which their inveterate foe tortures his victims.

To indicate more exactly its character, Mr. P. spoke of the classification of Dipterous insects, stating that this fly belonged to the same family as the common horse-fly. In reply to a question, Mr. Putnam also spoke of the bot-fly, its method of development in the stomach of the horse, and its effect upon that animal.

He concluded by exhibiting the skull and other parts of an Indian skeleton, presented by Mr. WM. JOHNSON, and with the request that the present or future owners of Indian relics would send them to the cabinets of the Institute.

Mr. ALPHEUS HYATT, continuing the description, commenced by Mr. Putnam, of specimens collected by the dredging party, exhibited some strips of eel-grass upon which were incrustations resembling groups of dots united by delicate white lacework. In the openings of this lacework lived minute animals which were beautiful objects when viewed through the microscope. They are called polyzoa. Although so minute and transparent, yet, the whole living process can be seen carried on in them as perfectly as in larger beings. Mr. Hyatt had seen them manifest emotion in the irritation produced when one would interfere with another's comfort. From an enthusiastic description of these microscopic animals, the speaker passed to some general remarks upon the lower forms of animal life, saying that every animal has a head, but in the lower animals this head is generally at the point of its attachment. It is not the seat of the governing power, and has not a high development. Still it is now well established that every animal has a head, or nervous centre. From a study of these lower animals one cannot but be strongly impressed with the unity of design shown by a similar plan of structure in all grades of animal life.

Mr. Hyatt also spoke of the deltas formed by the Merrimac, Ipswich and Rowley rivers, and described the methods by which deltas are formed. The probable depth of vegetable accumulations upon the delta forming the Rowley marshes is about two feet.

Mr. ALLEN W. DODGE having asked whether the clam had undergone any change since it was first known and used by man, Mr. PUTNAM stated that the clamshells in the ancient shellheaps were heavier than those upon clams now living. This, perhaps, indicated a deterioration and a possible future extinction of the clam.

Mr. Phippen introduced Mr. ALBERT C. PERKINS of Lawrence, who, he hoped, would speak for the botanical department.

Mr. Perkins described his visit to Prospect Hill, and exhibited several plants which he had there, and on the way thither, collected, among which were the Azalea or Swamp apple, *Pyrola rotundifolia*, *Lysimachia striata*, Orchis, Lobelia, the high and low Blueberry, etc. He was much impressed with the extensive prospect from this eminence, which partook of the character of a mountain view, revealing the village below, and a picturesque section of surrounding country, which included the hills of Boxford, Topsfield, and Hamilton, and Plum Island and part of Essex. The results of the researches in natural history, he said, were now within the reach of all, and the communities visited were much indebted to the young men, the speakers to-day, for the aid they were rendering in the study of natural history. He commended the work of the Institute and spoke of the "American Naturalist" as a publication of great value.

Mr. GEORGE D. PHIPPEN followed with farther remarks on the plants gathered. He prefaced his description by declaring that the naturalist felt that he had a certain right in every locality, because of the various natural objects which excite his interest and require his examination. The Institute had come to Rowley with that feeling, and acted accordingly. Taking up the plants upon the table he commented on the *Alisma plantago*; *Thalictrum cornuti*; *Asclepias cornuti*, the fibrous inner bark of which had been tested and prepared for the manufacture of thread and cloth; *Hypericum perforatum*, Spiraea, Geum, Pyrola, etc. He closed with some remarks upon the general plan of structure and distinctive characteristics of plants.

Mr. A. C. GOODELL, jr., of Salem, speaking for the Historical Department, said that the Institute greatly enjoyed a visit to such an old historical locality as Rowley. Its ancient burial ground was a place of great interest. Having quoted from Thomas Gray the lines:

"Beneath those Rugged Elms, that yew trees shade
Where heaves the turf in many a mouldering heap,
Each in his narrowed cell forever laid
The rude forefathers of the hamlet sleep."

The speaker said that our forefathers could hardly be called rude. They were largely men of culture and distinction, having among them many ancient divines and scholars. He mentioned that the remains of Ezekiel Rogers were interred in the Rowley cemetery and eulogized his character.

He read a paper prepared by Mr. MATTHEW A. STICKNEY, of Salem, concerning the descendants of WILLIAM STICKNEY, one of the first settlers of Rowley, who died in 1664.

Mr. Goodell then called upon Rev. Dr. PIKE, of Rowley, to inform the Institute concerning a certain epitaph said to have existed in Rowley Cemetery, which ran as follows:

"Oh Rowley, Rowley, thou hast sinned sore,
Thou hast lost thy Deacon Jewett and will never see him—again."

Dr. Pike, in reply, stated that no such epitaph could now be found in the grounds, nor could he find an authentic account of its having existed there. He defended the poetry of Rowley from the slander implied in the ridiculous rendering which some had given, by giving the true rendering of the epitaph as follows:

"Oh Rowley, Rowley, Rowley, thou hast sinned sore,
Thou has lost thy Deacon Jewett and will never see him more."

Dr. Pike still farther entertained the audience with accounts of some of the early inhabitants of Rowley, and spoke in complimentary terms of the labors of the Institute.

HON. ALLEN W. DODGE, of Hamilton, raised the question "Cui bono?" What is the use of these studies of the naturalist? This question he answered in part, but he wished it to receive a more complete illustration. He would like to know what is the use of learning all about these bugs and the ravages of insects if we were not told how to get rid of them. A general knowledge of natural science, he admitted, was useful to public speakers. Some speakers and authors had been guilty of gross mistakes, in selecting illustrations from natural history, for lack of accurate knowledge of the objects to which they referred. He asked the same question concerning the tracing of one's ancestry. He thought we had much better ask what are we ourselves than who are our ancestors.

Mr. F. W. PUTNAM, in reply to Mr. Dodge, remarked that the power of scientific men to arrest the ravages of insects was limited to informing the public as to the best method and the best period in the life of the insect for effecting its destruction. But what is needed is the general adoption and carrying out of the suggestions of the naturalist by the farmers. The failure of a few to do their part, keeps alive a sufficient number of breeders to make the efforts of many, to destroy insects injurious to vegetation, futile. To secure the coöperation of the farmers the legislature must enact the necessary laws and appoint agents to enforce their execution. To show the difficulty of obtaining such legislation he alluded to the fate of a proposition, made by an entomologist to Congress, to suppress the ravages of the Hessian fly, which had destroyed millions of dollars worth of grain, by importing its parasites. The proposal was ridiculed and rejected as an absurdity. On the other hand the French Government had arrested the

destructive work of a species of beetle by offering a few *sows* a quart for the grubs.

Mr. D. B. HAGAR, Principal of the Normal School at Salem, found that the Essex Institute caught speakers as they caught bugs, by pouncing upon them unawares. He added to the illustrations of the uses of scientific studies given by Mr. Dodge. Science was of value aside from its material uses. Whatever brings good thoughts, good emotions, is useful. He believed that to lift the rising generation out of its selfish struggle for money we should encourage the study of the natural sciences. The speaker pleasingly and happily illustrated these thoughts. He contrasted the real enjoyment of the liberally educated mind with the poor pleasure of the avaricious money seeker. He spoke of the happy influence of the Institute. He remembered the time when the Institute members were contemptuously called bug-hunters. This term and the tones in which it had been spoken had given him a poor opinion of the Institute and its work. But a more intimate acquaintance with its doings had brought him to count it an honor to be numbered among these bug-hunters.

Mr. A. C. GOODELL, jr., in reply to remarks previously made by Mr. Dodge, asked that Mr. Dodge would apply the doctrines of stock breeding which he advocated at agricultural meetings, to the human race. Then he must admit that it was of some importance from whom we are descended. This occasioned an amusing discussion, brief and sharp, which the lateness of the hour arrested.

The following vote of thanks, on motion of Mr. CHARLES DAVIS of Beverly, was unanimously adopted:—

Resolved, That the thanks of the Institute be tendered to the citizens of Rowley for the use of the Town Hall, and their most generous and courteous reception of us, notwithstanding we have chosen this busy season of the year for our Field Meeting with them; to the officers of the first Congregational Society for the use of their meeting house; to Rev. John Pike and his thoughtful partner for their assiduous attentions during the day; to Messrs. Benj. H. Smith, John Boynton, A. Boynton, Joseph Hale, William C. Foster, George Kimball, John S. Prime, Moses T. Whitney, Mark R. Jewett, John Richards, Thomas Prime, Edward Smith, and Mrs. Kilham, and Miss Anna Titcomb, who have furnished us with carriages to convey us to and from our place of gathering, and have acted as guides; to Capt. B. H. Smith, Capt. A. M. Hill, M. R. Jewett, John Harris, Frederic Todd, Gorham Smith and wife, Mrs. B. Cressey, Mrs. Blodgett, Mrs. M. R. Jewett, and Mrs. D. B. Prime, who have served us at the table, and provided us with many comforts at our collation; and lastly to the Rowley Band, who have surprised us as much by their fine appearance and excellent music, as by their great kindness in offering their services for this occasion.

Resolved, That this day will be long remembered by us, and is another enduring testimonial to that spirit of brotherhood and goodwill which the Essex Institute ever deems it one of its highest objects to promote among all citizens of the county.

Samuel R. Nichols and Samuel G. Jones, both of Salem, and Richardson Knowland, of Marblehead were elected Resident Members.

THURSDAY, AUGUST 6, 1868. — Field Meeting at Marblehead.

According to the Programme, this meeting, the fourth of the present season, commenced at the Eastern Railroad Station, at 9.15 A.M.; the majority of the members and friends of the Institute who attended the meeting, numbering more than four hundred persons, taking the cars at the above named hour.

Several of the members embarked on the yacht *America*, at Derby wharf, in the early morn, to collect marine specimens by dredging and grappling. The boat was headed first for the Beverly shore to receive Prof. S. F. Baird of the Smithsonian Institution at Washington, and Rev. Joshua A. Swan from Kennebunk, Me. On the way some eelgrass was picked up, thickly coated with hydroids and bryozoa. The whole number of persons expected being received on board, the morning's work began.

Strickly speaking, this was not a dredging, but a grappling party, on their way to search the kelp-grounds in and around Salem harbor. For this purpose they were furnished with a suitable grapple consisting of an iron bar about fourteen inches long, with a loop of iron on one side, and four groups, each containing four stout iron hooks on the other side. By the iron loop this contrivance is attached to a stout rope, while a heavy iron weight is attached about five feet above the hooks. When thrown overboard the weight drags along the bottom, while the bar comes trailing after, lying upon its side and presenting the points of its hooks to catch whatever lies in its course.

The yacht was sailed over kelp-grounds, the grapple thrown over, and after dragging a short distance was drawn up loaded with the kelp weed. A hungry rush of eager naturalists and soon the hooks were cleared, and each man sat searching the leaves, the stems, and especially the roots of the weed with one eye, while he guarded the material he had appropriated for his personal examination with the other. This latter work was much less effectively and successfully done than the former. Meanwhile the grapple was thrown again. The kelp market soon became glutted. Then a more peaceful and quiet enjoyment of the many fine and beautiful specimens of marine animals took place. The glass jars were rapidly stocked with strange and elegant forms of life, conspicuous among which were brilliantly colored worms with fringed extremities. Thus was kept the promise of the proverb to early birds.

A net was occasionally used to capture some medusæ as they floated by, and beside the more common form (*Aurelia flavidula*), one (*Idyia roseola*) was secured, of oval form, whose pink, radiating tubes, covered with beautiful fringe in constant motion, gave it great beauty.

On landing at Marblehead, about noon, sufficient time remained before the hour for the afternoon discussions to permit of a visit to some Indian shellheaps situated in a grove on the northern shore of the town. With recovered vigor this expedition was entered upon and accomplished with much pleasure but little profit. Those who arrived at Marblehead earlier in the forenoon, rendezvoused at the Town Hall, divided into companies as is customary, and some with, and some without guides, went in various directions to explore the town. One party, with patient and laborious digging examined the shellheaps above mentioned.

Many went to the Neck, crossing in boats, and visited the camps where people from Nashua, Lowell, Worcester and other places are "dwelling in tabernacles," and enjoying the delights of the sea-shore. There are several hundred of these summer residents now on the Neck, and their camps are known by the names of the places whence their occupants came, such as "Nashua Village," "Camp Worcester," etc. A few wooden houses have been erected for the accommodation of summer visitors, but the great majority live for the few weeks of the heated term in canvas tents, and as cold weather approaches they "take up their beds and walk" or ride to their distant and more permanent homes. Some of the land on the Neck appears to be in a high state of cultivation, and the portion leased and improved by Mr. ELIAS HAM attracted special notice for the excellent vegetables growing thereon. Many interesting Indian relics have been found here, and Mr. Ham presented several valuable specimens to the Institute.

Others of the party went to Fort Sewall, where they were received with polite attention by the officer in charge. The government works were admired for their beauty and for the manifest care still bestowed upon them.

The fine old mansion of Dr. DANIEL GILE attracted many visitors, who were permitted by the genial proprietor to inspect the identical room where Vice President Elbridge Gerry first saw the light.

The magnificent geological, mineralogical and archæological collections of Mr. JAS. J. H. GREGORY were also visited at his residence.

The excellent Reading-room of Dr. J. WELLMAN attracted many who desired to book themselves up in the news of the day, and to whom the proprietor sent a kind invitation to give him a call.

A few antiquarians accepted the invitation from GLOVER BROUGHTON, Esq., the Town Clerk, to inspect the ancient town records. The old deed, conveying "the towne ship of Marble Head" from certain

unpronounceable Indian names to certain English named trustees, dated in 1684, was an object of special interest; the grantors hall of Natick, in the Colony of Massachusetts Bay.

The old Bank building was examined by many of the party, who were interested in the peculiar architecture and decorations of an aristocratic residence of a century ago; even the paper on the walls was imported from England. This structure is supposed to have been built in 1768, for Col. Jeremiah Lee, and, like the Sparhawk and Pepperrell houses at Kittery, is a fine specimen of the palatial mansions of the nabobs of the last century. The venerable cashier, JOHN SPARHAWK, Esq., who occupies a portion of the building, very kindly received the company and politely permitted them to inspect the premises.

The old Burying Hill, and indeed many other places of interest, were not forgotten or neglected by the Institute party.

At one o'clock all gathered at the Town Hall, where a pic-nic collation, arranged from the baskets by a committee of ladies, was quickly transferred from the tables to the hungry mouths of the rovers.

From the Town Hall went all to the Universalist Church, where the customary meeting for reports and discussions was called to order by the PRESIDENT at half past two o'clock. The records of the last meeting and the correspondence were read by the SECRETARY. Donations to the library were announced by Mr. ALPHEUS HYATT, and donations to the cabinet by Mr. F. W. PUTNAM.

After a brief allusion to a former Field Meeting of the Institute held at this place ten years ago, and to the part which a former pastor of this church, Rev. Stillman Barden,* had taken in the proceedings at that time, the PRESIDENT invited Mr. JAMES J. H. GREGORY of Marblehead, as one well versed in the geology of the region, to impart to the audience the information he had acquired. In response, Mr. Gregory gave a very clear and interesting description of the geology of the town. It is for the most part composed of sienite and greenstone, cut by veins of trap. At the north part of the town the greenstone cuts the sienite; at the south they blend. At the lower part of the town is a rose-quartz, which would make excellent building material. At Burlington, Vt., he had seen a church built of alternate blocks of quartz and limestone, and the effect produced was very pleasing. The solution of the question as to the probable method by which the trap was formed, was contained in a single vein of trap in

* Rev. Mr. BARDEN was an active member of the Institute, a frequent attendant upon these meetings, and a zealous mineralogist and geologist. He died at Rockport, August 7, 1835, to which place he removed in August, 1861. A memoir of Mr. Barden by Rev. Mrs. P. A. HANAFORD is printed in the seventh volume of the *Historical Collections of the Essex Institute*.

the town, in which a block of greenstone was so imbedded as to show that it fell in while the trap was in a molten state. There is a magnificent development of porphyry at the Neck which runs submarine and appears at Tinker's Island, then runs submarine and again emerges at half-way rock. The back of the Neck is porphyry and sienite with greenstone. The latter is here and there washed out so that great chasms are thus produced. He accounted for the crookedness of the streets of the town by stating that they followed the natural valleys. Moreover, nearly all their cellars have been made by blasting. The rock in which they are formed is very hard, so that to save expense houses have been placed where the cellar could be most easily obtained. Their pastures are excellent, and although used through several generations grow better instead of poorer. This is owing to the fact that the nourishment for the vegetation is furnished largely by the disintegration of the stones abounding in them.

Mr. C. M. TRACY of Lynn, described in a very happy style, some of the plants that had been gathered. Among which were the orchis, cleaver, wild bergamot, button-bush, etc. The collection of botanical specimens was very large and Mr. Tracy felt compelled to give place to others before a small portion only had been described.

Mr. ALPHEUS HYATT commenced a description of the large number of marine specimens collected from the kelp. Remarking that it is not generally known that we have native sponges, he exhibited a specimen of sponge attached to the root of a kelp weed. He explained the structure, growth and method of development of sponges, saying that they were compound animals, that is, a community of animals, living in a common investing membrane. The utility of the sponges of commerce is owing to the development of horny fibre in this membrane, in the place of calcareous spiculæ which form the framework of our native sponges.

Upon a muscle shell exhibited was a gelatinous spot which proved under the microscope to be a community of animals belonging to the class of Mollusks, and named Ascidians. They are similar in general structure to the clam. A question here being asked concerning the clam, Mr. Hyatt described its anatomical structure. He also passed around in a bottle and described some specimens of the Bryozoa or moss animals, as illustrating the composite animals call Polyzoa.

Mr. GEORGE D. PHIPPEN of Salem, continued an account of the plants. On his way to the meeting he had collected the common weeds, and he proceeded to give an interesting account of their introduction and classification. The greater part of them were introduced foreigners, the gypsies of vegetation. A weed had been defined to be "a plant out of place," but a true weed was more than that, being troublesome and useless.

Mr. F. W. PUTNAM continued a description of the marine specimens. He said that Mr. Hyatt had spoken concerning representatives of the Protozoa and Mollusks. Between these two classes is another called the Radiates. Belonging to this class were the star-fishes, the sea-urchins, the brittle stars, and the jelly-fish. The distinctive characteristic of these animals is that the different parts of their structure all radiate from the mouth. After a minute account of their anatomical peculiarities, he gave an interesting description of the various and multitudinous forms of life found on the roots of kelp. He had found, to-day, upon them, representatives of all the classes of the animal kingdom, excepting mammals, birds, reptiles and insects. In concluding he announced the donation to the Institute of an Indian gouge by Mr. R. RAMSDELL.

Mr. GREGORY of Marblehead, in reply to request from the President, gave an account of a valuable collection of Indian relics, numbering upwards of two thousand, made by himself during the last eighteen or twenty years. Marblehead, he believed, was, to the Indians, a manufacturing centre. This was indicated by the number of imperfect and half-formed implements and the numerous chippings of stone found. Here also was an Indian fort, whose identity he considers as thoroughly established. Salem, he said, had appropriated the name of Naumkeag, when it more properly belonged to Marblehead. The Indian name meant "good-fishing ground;" therefore inappropriate to Salem, for when Salem people went "a fishing" they came over to Marblehead.

The PRESIDENT, after brief allusion to the ancient history of the town, announced that the hour for closing the meeting had nearly arrived. Whereupon the following resolution of thanks was unanimously adopted:—

Resolved, That the thanks of the Institute are hereby presented to the Proprietors of the Universalist Church for the use of this place of meeting; to the Sutton Light Infantry for the use of their tables; to the Selectmen for the use of the Town Hall; to Messrs. J. J. H. Gregory, J. P. Haskell, R. Knowland, J. E. Hiler, Mason Harris, William Gilley, jr., John Sparhawk, A. Lackey, Mrs. M. H. Reynolds, and John W. Reynolds, for polite attentions; and to many other citizens of the town for many acts of courtesy to our party during the day.

THURSDAY, SEPTEMBER 3, 1868.—Field Meeting at Topsfield.

The fifth Field Meeting of the present season was held at Topsfield. The number in attendance was large, the Eastern Railroad furnishing an extra train to connect with the regular train over the Danvers and Georgetown road. On the arrival of the party at Topsfield, they assembled at Union Hall under the Methodist Church, where they were

welcomed to the ancient town by Prof. NEHEMIAH CLEAVELAND, who alluded to the characteristics of the place, particularly to some features of its history. He spoke of the Indian name of the place, *Shenewcmedy*, and said that its unwritten Indian history was of course almost unknown. There were no mounds or cemeteries giving definite memoranda of what the place was prior to the advent of the white race. No Indian relics had been found, excepting a few rude utensils which are frequently dug up, as stone chisels, hammers, arrow-heads, etc., etc.

The first white settlers came here from Salem and Ipswich, the earliest official record bearing date of 1639, when what is now Topsfield was included in Salem Village. In 1642, New Meadows seemed to comprise a portion of Salem Village, and this conflict of boundaries appears to have created a serious dispute, which in witchcraft times had produced the most bitter hatred between the contestants. In the first records of New Meadows it is shown that John Endicott owned 500 acres of land in what is now the western part of Topsfield, and a grandson and two of his sons settled here. Simon Bradstreet owned 500 acres in what is now the eastern part of the town, and one of his descendants is still living on the hill. It was through the influence of Mr. Symonds, who came here from Ipswich, that the name of Topsfield was adopted, from the parish in England whence he came. The town was incorporated in 1650. In 1692, Abigail Hobbs of Topsfield was one of the earliest accusers in the witchcraft prosecutions, her own parents even being among her victims. Mary Esty of Topsfield was arrested and released, and again arrested, convicted and executed. B. W. Crowninshield subsequently occupied the house in which Mary Esty had lived.

Among the old families of Topsfield we find the names of Gould, Perkins, Peabody, Wildes, Porter, Dwinells, etc., whose large posterity are widely scattered over the country. Mr. Cleaveland claimed that Topsfield was a pleasant town, though not striking. The hills afford interesting views of the ocean, of several mountain peaks and of the surrounding towns. Ipswich river runs through Topsfield, and there are several smaller streams. The "mudsills" of some of the brooks had in former times been a fruitful source of dispute and litigation. Among the ponds, that known as Pritchard's, or recently as Hood's pond, is most worthy of mention.

In 1648, Gov. Endicott discovered copper on his farm, and three attempts have, at different periods, been made to render the working productive, but the yield is not sufficient to be profitable.

Mr. Cleaveland also alluded to some of the old buildings in the town, tracing the ancestry of Joe Smith, of Mormon notoriety, to a house still standing in Topsfield. The house in which Capt. Thos.

Perkins was born was also pointed out. In concluding his remarks, he stated that agriculture was the principal productive industry of the town, although there were several extensive shoe manufactories, a wagon manufactory, etc., all of which enjoyed a reputation for good work.

The company then separated into small parties, and under the direction of kind guides, visited the several localities of interest; many ascended the "Great Hill" and enjoyed the extensive and beautiful views from that eminence; some visited Hood's Pond; some went to the Academy, some to River Hill, the cemeteries, etc., while the great majority at some time during the day called at the old Capen House, which is said to be over two centuries old, and whose proprietor has returned so far as practicable to the original plan and finish of the house throughout; while the farm bequeathed to the Essex Agricultural Society by the late Dr. John G. Treadwell, was not neglected. The farm is now carried on by Mr. A. H. Gould, who, in accordance with the provisions of the Treadwell will, is conducting a series of experiments in practical agriculture.

The Great Hill is well named, its massive dimensions fully justifying the title. Quite a number of the party visited it and toiled up its tedious ascent. From its summit a magnificent panorama of Topsfield and the surrounding country is spread out, the scenery presenting a picturesque combination of village, house dotted hills, woods and isolated settlements. As the eye sweeps the horizon, distant mountains present their cloud-like outlines, while the settlements at Beverly, Wenham and Hamilton, and the white beach at Ipswich are plainly in sight.

The high lands and bald hills of the surrounding towns are conspicuous, the meeting-house at Linebrook parish, within the limits of Ipswich, appearing conspicuously and apparently at the foot of one them. At the foot of Great Hill, on the eastern side, there is quite a little village, and not far from this locality, there are numerous hollows and remains of cellars where it is supposed the original settlers of Topsfield dwelt. This locality is called "the College," because the town officials and like dignitaries, are said to have resided there.

The locality of the copper mine is in the south-west side of the town, near the Danvers and Middleton lines. In July or August, 1839. it was opened, with what was then thought a fair promise of success, both as to the quantity and quality of the metal; but nothing came of the effort, and nothing remains of the mine more valuable than its traditional reputation. The story which led to the effort to work it in 1839, is substantially this :—Seventy years before, an Englishman, named Bunting, of a scientific turn and solitary habits, while rambling

about, discovered evidences of copper ore, some of which was obtained by excavating. He made known his discovery to the owner of the land and entered into an agreement to work it at his own cost, giving the owner one-sixteenth of what was obtained. A vessel load was dug and shipped to England, but Bunting, who accompanied it, was taken sick and died, and no one knew what became of the ore. In process of time the affair was forgotten except by one or two of the "oldest inhabitants." Subsequently one of Bunting's descendants, finding the old agreement of his ancestor concerning the ore, and thinking there might be wealth in store, came to the "Province of Massachusetts, North America," and found an old man in Topsfield who remembered the affair. There is no record, however, that the young Englishman saw a prospect sufficiently flattering to attempt to work the mine. But this tradition is supposed to be at the bottom of the attempt to work it thirty years ago.

The Capen House is one of the old houses alluded to by Mr. Cleaveland. It is situated close to the meeting-house, and was consequently visited by a large number of the party. Mr. CHARLES H. HOLMES, the owner and occupant, was quite attentive in showing the visitors around and pointing out the peculiarities of the old place, which is now not far from two hundred years old. It is supposed to have been a garrison house in the days of Indian troubles, and, though not built by him, was soon owned by Mr. Capen, a minister of the place for a period of forty-two years. The house has been in the Emerson family, with which Mr. Holmes is connected, for upwards of one hundred and fifty years. It possesses all the peculiarities of the structures of the early period, and the visitors, when they contemplated the fact that the entire stud of the first story was required to accommodate Mr. Holmes from head to toe, were unanimous in the opinion that the original builders must have been unmindful of the dimensions that would require shelter under its roof two centuries afterwards.

Topsfield, as Mr. Cleaveland remarked in the morning, has three burying grounds; one of which, the cemetery on the Georgetown road, was visited. Here lie buried three of the old ministers of the town, Capen, Emerson and Huntington. To the Rev. Asahel Huntington a granite monument is erected, on which are inscribed the names of other deceased members of the family. Here too, repose the remains of Thomas Perkins, the eminent Salem merchant, who was associated with the late Joseph Peabody, and who bequeathed the Franklin Building to the Salem Marine Society. His modest tombstone bears this inscription:

In memory of THOMAS PERKINS, Esq., an eminent merchant. His industry, temperance and enterprise raised him from poverty to immense wealth, which he enjoyed without pride or ostentation, and dispensed with justice and benevolence. He was diligent and faithful in business, pure in his life and conversation; of a sound and vigorous mind, and of an integrity and fortitude which neither pros-

perity or adversity could shake or corrupt. He was an affectionate son, a kind relative, and a firm friend. He was a Christian above sectarian prejudice, and a man above fear and without reproach. He was born in Topsfield, April 2, 1758, and died Nov. 24, 1830."

The inscription which denotes the resting place of the remains of Rev. Joseph Capen, who owned the old house above referred to, reads thus:—

"Here lyes Buried the Body of the Reverend Mr. Joseph Capen A Faithful Minister of Christ who lived an ordained Pastor of ye Church in Topsfield 42 years & Departed this Life ye last day of June 1725, aged 66 years.

Dear Mr. Capen that reuered man, who did the Faith of Christ maintain. A Learned Man and Godly too. None will Denie this who him knew."

Mrs. Capen, his wife, is thus commemorated:—

"Here lies Buried the Body of Mrs. Priscilla, ye wife of ye Rev. Joseph Capen, who died Oct. 18th, 1743, in the 86th year of her age."

If the poetry of Mr. Capen's inscription is of doubtful excellence, it is not more striking, in this respect, than the following effort to immortalize Mr. David Balch:—

MEMENTO MORI.

"This monument, as a mark of filial respect, is raised to the remembrance of DAVID BALCH, who bid adieu to the delusive and transitory scenes of this world on the 22 of July, 1812, Æ. 59. Whose last dying words were, 'To the war.'

'Non ille pro caris amicis

Ant patria timidus perire.'

Sweet Jesus was resigned to the

Father's will,

Indeed so was he who lies here still."

Mr. Balch died by suicide. In the Latin inscription above given, his eulogist aimed to convey to the world the idea that he was not afraid to die either for his dear friends or his country.

Another queer inscription is that upon a stone erected by Amos Lefavor, of a family of scattered Acadians, to the memory of Mary Lefavor, who died May 28, 1797, aged 74. It runs thus:—

"Reader pass on, ne'er waste your time

On bad biography and bitter rhyme;

For what I am, this cumbrous clay ensures,

And what I was, is no affair of yours."

There are many other things of interest connected with this town which might be named if our limits served.

With all the attractions and associations of the place, and the kind attentions of the citizens, the party found no difficulty in deriving pleasures from their rambles and knowledge of their good country neighbors, who, at the collation, which took place at one o'clock in the basement of the Methodist Church, spared no efforts to promote the substantial comfort of the guests, furnishing delicious tea and coffee as well as more substantial elements, in addition to the contents of the baskets carried by the visitors.

At 2 o'clock, the meeting for reports, discussions and speaking was held at the Methodist Church, which was crowded with an attentive audience; many people of the town were present to listen to the ex-

ercises. The PRESIDENT in the chair, and in the absence of the Secretary Mr. PUTNAM was appointed to the place; the record of the preceding meeting was read; the donations to the library and cabinets since the last report, and the correspondence, were announced by the proper officers.

The PRESIDENT in opening the meeting made a few remarks, alluding to this place as the geographical centre of the county and before the introduction of railroads very often selected for the assembling of conventions of various kinds, political, educational, religious, etc. The Agricultural Society held its first cattle show in this town in 1820, when Dr. Andrew Nichols of Danvers delivered the address; an important meeting for organizing Lyceums in this county was held in 1829, when the Hon. D. A. White delivered a very valuable and instructive lecture; the meeting for the completion of the organization of the Essex County Natural History Society, incorporated in 1848 with the Essex Historical Society, under the name of the Essex Institute, was held in April, 1834. The first Field Meeting of the Institute, under its present system, was held in the Academy building in June, 1856, another meeting was held in 1860, and this is the fourth time that the society has assembled in this place.

Mr. SAMUEL P. FOWLER, who was present at the first meeting, was called upon and gave a very interesting account of that first gathering of a few devoted friends of natural history, including Dr. A. Nichols of Danvers, Wm. Oakes of Ipswich, Rev. G. B. Perry of Bradford, B. H. Ives of Salem, and others, who have long since been gathered to their fathers; and contrasted that day of small things with the meetings of the present time.

Mr. F. W. PUTNAM described his experience while on his way to the pond, having picked up some zoölogical specimens under the fallen trunk of an old pine tree, consisting of spiders, two or three species of centipedes, including the common earwigs, and crustaceans represented by the sow-bug and pill-bug, and specimens of several kinds of snails. Three species of salamanders were also collected under the log. On turning over a stone, a tree-toad jumped forth. This animal, which he exhibited to the audience, will change its color, like the chameleon, and has the power of walking up a pane of glass as easily as a fly. Mr. Putnam described the large yellow spider, of which he had several specimens, which has the habit, on the approach of an intruder, of making its web vibrate so rapidly as hardly to be seen. He also explained the structure of spiders generally, and compared them with other insects, and described the interesting process by which they spin their thread. He likewise spoke of the beetles found on the potato vines here, which are not, as has been feared, the much dreaded Colorado potato bug. He also exhibited a collection

of Indian implements that had been presented, and spoke of their peculiarities and probable uses.

Among the specimens presented to the Institute, were a small stone gouge from J. W. BATCHELDER; club-stone, gouge and small axe, from J. ARTHUR LAMSON; a large stone gouge, from Z. GOULD. These were all found in Topsfield where the donors reside. Dr. Charles Palmer presented from GEORGE CALDWELL of Ipswich, seven stone implements, among them a singular and unique implement, and a fine corn-smasher and peculiar form of a small gouge. EBEN H. LAKE of Topsfield, placed several stone implements on the table for exhibition.

Mr. NEHEMIAH CLEAVELAND, during Mr. Putnam's remarks, asked whether the common house adder was a venomous reptile; to which the latter replied that the rattlesnake was the only venomous snake found in this locality. He was aware that the house adder and the water adder were called venomous, and it is true they will show fight and bite on provocation; but they are not provided with poison fangs and their bite is harmless.

Mr. ALPHEUS HYATT spoke of the felspar, quartz, and mica which composed the rocks of Salem and vicinity, and alluding to the mass of disintegrated rock near by, inferred, from its northwest dip, that it was a rock in place and was not transported there as had been supposed, by glaciers during the drift period. He thought this rotten rock might be occasioned by the presence of iron, the rust of which has a disintegrating effect. He said we know nothing, comparatively, of the geology of New England compared with that of the states west of the Hudson, and explained the glacial theory, in tracing the cause of the formation of gravel beds.

In describing his collection of animals at the pond, he spoke of the Polyzoa, or moss animals, which inhabited the surface of floating boards and the stems of the lilies. He also described the club moss, in its geological relations as a representative of ancient life.

In answer to a question, Mr. Hyatt illustrated on the blackboard the process of the formation of the North American continent.

The PRESIDENT, after alluding to his faithful and arduous services as Adjutant General of the state, introduced Gen. WILLIAM SCHOULER of Lynn, who responded by saying that he had been interested and instructed at what he heard and would gladly listen to others, being ignorant of science, and the subjects treated of being so different from his customary pursuits, he would be unable to edify the meeting. It was his first visit to Topsfield, and his first meeting with the Institute, but he trusted that it would not be the last. He expressed the interest he had felt in listening to the remarks of the previous speakers, his appreciation of the beautiful town and his gratification

at the warm reception and kind attention extended by the citizens. These meetings were fraught with valuable information, and he hoped they would long continue to exert their salutary influence.

The venerable Dr. J. SPOFFORD of Groveland, gave some interesting reminiscences from his own recollections of the earlier history of Topsfield and vicinity, and alluded to the Capen house which had attracted so much attention during the former part of the day. He then gave a genealogical history of the Capen family, and a description of the house occupied by them, now some two hundred years old, and named some of its occupants who had become somewhat famous in local history. He said that he was somewhat puzzled to know why they built the second story with a projection, and also with a higher stud than the lower.

Mr. CHARLES H. HOLMES explained the projection as being the style of architecture prevailing in Holland, whence the builders of this house emigrated, and said that it was out of respect to their Dutch proclivities that they introduced the practice here.

Dr. SPOFFORD thought that explanation might do pretty well, but he wanted to know why the Dutch built in that style.

Mr. WILLIAM B. TRASK of Dorchester, editor of the "Genealogical Register," read the inscription on the tombstone of Rev. Mr. Capen for whom the Capen house is named, and gave an historical sketch of the Capen family, and traced its connection with an ancient Dorchester family of that name.

Mr. SAMUEL TODD of Topsfield, differed from Mr. Hyatt in his opinion (expressed during the early part of the meeting) that the disintegrated rock was an original bed. He had had much experience among the rocks in this vicinity, and said one could not dig anywhere in the village deeper than from nine to twelve feet without getting water. This, with the fact that he had taken sand from under parts of this bed, led him to believe that this rock was deposited here, and that the drift period was the agency that formed the town of Topsfield.

Mr. HYATT complimented Mr. Todd, by saying he wished the Institute could meet with more of such men at their meetings, and also remarked that it was rare to find so many men as they had met with here, well versed in geology. Nevertheless, he was confident that Mr. Todd was in error in his supposition that this mass drifted hither, and adhered to his proposition that this rock, in its general formation, conformed to every rule which marked the fixed rocks of adjacent localities.

The subject was continued briefly, by Mr. NEHEMIAH CLEAVELAND, who coincided with the views advanced by Mr. Hyatt regarding the character of the rock.

Rev. Mr. BRIDGE of Topsfield, expressed the gratification afforded to himself and the citizens of the town at the visit of the Institute.

On motion of Mr. SAMUEL P. FOWLER of Danvers, the following vote was passed :—

Whereas, in view of the almost total lack of interest felt in the preservation of ancient buildings;

Resolved, That the thanks of the Institute are due to Mr. Charles H. Holmes for so well preserving the "Capen house";

Resolved, That the Institute will do all in its power to build up a public sentiment in this direction.

On motion of Mr. T. M. STIMPSON of Peabody, warmly seconded by Mr. E. N. WALTON of Salem, the following resolution was unanimously adopted :—

Resolved, That the thanks of the Essex Institute be presented to Messrs. Richard Phillips, jr., Nehemiah Cleaveland, B. P. Adams, Ezra Towne and Chas. J. Peabody; Mrs. A. H. Gould, Mrs. Jacob Foster, Mrs. Samuel Adams, Mrs. Richard Ward, Mrs. T. K. Leach, Mrs. Richard Phillips, Miss Abble Cleaveland and other friends who have contributed to render this meeting so interesting and profitable. Also to the Methodist Society for the use of their church.

The meeting then adjourned to Friday.

FRIDAY, SEPTEMBER 4, 1868. — Adjourned Meeting.

The PRESIDENT in the chair.

Mrs. Bradstreet Cressy of Rowley; Benjamin R. Allen, Wm. W. G. Haskell, William B. Brown and James J. H. Gregory, all of Marblehead, were duly elected Resident Members.

MONDAY, SEPTEMBER 7, 1868. — Regular Meeting.

The PRESIDENT in the chair.

Adjourned to Tuesday, September 8.

TUESDAY, SEPTEMBER 8, 1868. — Adjourned Meeting.

The PRESIDENT in the chair.

Charles Palmer of Ipswich, Samuel Preston and Harriet W. Preston of Danvers, Joseph Kidder of Salem, and James B. Batchelder of Marblehead, were duly elected Resident Members.

MONDAY, OCTOBER 19, 1868. — Regular Meeting.

The PRESIDENT in the chair.

A committee was appointed, consisting of Henry M. Brooks, W. P. Upham, George Perkins and John Robinson to confer with a committee of the Trustees of the Peabody Academy of Science, relative to

receiving on deposit by the Institute, Historical Specimens, Books, Pamphlets, etc., in the custody of the Peabody Academy of Science.

WEDNESDAY, NOVEMBER 11, 1868. — Quarterly Meeting.

The PRESIDENT in the chair.

Voted, That a committee of ten persons, consisting of the President, 1st Vice President and Secretary, together with Messrs. F. W. Putnam, R. S. Rantoul, W. P. Upham, E. H. Quimby, A. Hyatt, G. D. Phippen, and James Kimball, be hereby appointed to publish a Guide to Salem if they may deem it expedient, with full powers to add to their numbers as may seem to them necessary.

Dr. A. S. PACKARD, jr., in compliance with a request made at a previous committee meeting, proposed a plan for an Annual Report on the Progress of Entomology in America.

On motion of Mr. PUTNAM: — *Voted*, to recommend the substitution of the word *three*, or the word *five*, before the word dollars, for the word *two*, in article seven of the Constitution.

The following Amendment to the Constitution was adopted: —

Article II. Substitute for the word "Secretary" the following words, — A Recording and Home Secretary and a Foreign Secretary.

James T. Hewes of Salem, was elected a Resident Member.

MONDAY, NOVEMBER 16, 1868. — Regular Evening Meeting.

The PRESIDENT in the chair.

Records of last meeting read; correspondence and donations announced.

The PRESIDENT announced that tidings had been received of the death of Mr. HORACE MANN of Cambridge, a gentleman well known to many of the members of the Institute as the acceptable and instructive lecturer on Botany before the Institute during the past spring.

Mr. F. W. PUTNAM stated that Mr. Mann died on Wednesday last. He was an accomplished and rising botanist. He was appointed as the substitute of Prof. Gray, in Harvard University, during the Professor's absence in Europe. About two years since he visited the Hawaiian Islands and collected a vast amount of material, illustrative of the Flora of those Islands, which he was preparing for publication, a portion having already appeared in the Proceedings of the Institute.

Mr. Putnam read the following resolutions, which were adopted:

Resolved, That the members of the Essex Institute most deeply sympathize with the family and friends of their late associate, HORACE MANN, whose sudden death not only casts a deep sorrow on the hearts of those who were near and dear to him, but also into the scientific

bodies with which he was connected, and deprives his loved science of botany of one of its most devoted and conscientious investigators, and of one, who, had it been permitted, would, from his purity and depth of thought, undoubtedly have made one of the leading botanists of his generation.

Resolved, That the Secretary be requested to transmit a copy of these resolutions to the family of our late associate, and to tender to them our condolence and sympathy in this bereavement.

Mr. ALPHEUS HYATT feelingly alluded to the great loss which had been sustained in the death of Mr. Mann and proposed the following resolution, which was adopted:

Resolved, That Dr. A. S. Packard, jr.,* be requested to prepare a memoir of Mr. Mann to be inserted in the Proceedings of the Institute.

Dr. GEORGE B. LORING stated that he had known Mr. Mann as a boy. We are apt to pass boys, but this boy arrested his attention. When lecturing in Salem last winter Mr. Mann had been the speaker's guest. He was then struck with his accuracy of information; his wisdom of thought and propriety of expression. He partook eminently of the nature of a scholar. He had come to us as the result of the training of his father and the educational institutions of this Commonwealth.

Mr. PUTNAM announced the recent decease of two other botanists, corresponding members of the Institute, W. W. DENSLOW of New York, better known as a collector than as an investigator; and the Rev. JAMES HUBBERT of St. Francis College, Canada, who prepared a "Catalogue of Canadian plants." Both were enthusiastic workers for, and correspondents of the Institute.

The PRESIDENT exhibited a blotter, a donation from Dr. Samuel A. Green of Boston, and read an extract from the "Boston Traveller," which gave an account of a tornado by which this book with other articles were carried many miles through the air.

Mr. A. HYATT gave an interesting account of his observation of the Meteoric Shower of Nov. 13, and mentioned many interesting speculations to which the Meteoric Phenomena had given rise in the ancient and modern efforts to explain the nature and course of their bodies.

A discussion followed, participated in by Mr. G. D. PHIPPEN, Dr. G. B. LORING and others.

MONDAY, DECEMBER 7, 1868. — Regular Evening Meeting.

The PRESIDENT in the chair.

Records of last meeting read; correspondence and donations announced. [The violence of a storm had so interfered with the as-

*Another friend of Mr. Mann's has prepared a memoir, in place of Dr. Packard, which has been printed in the "Bulletin of the Essex Institute," Vol. I, Nos. 2 and 3.

sembling of the members that the reading of the communications were deferred to the next meeting.]

MONDAY, DECEMBER 21, 1868. — Regular Evening Meeting.

The **PRESIDENT** in the chair.

Records read and correspondence and donations announced.

The **PRESIDENT** stated that during the past season he, in company with a friend, had visited the American Antiquarian Society's Hall at Worcester, and by the politeness of the officers in charge, had the privilege of examining the journals and other papers kept by the late Rev. Dr. Bentley. These manuscripts comprise about twenty closely written volumes, containing an account of the leading events which occurred in Salem during the time of Dr. Bentley. He read several extracts from them, exhibiting somewhat the fulness with which the leading events in Salem during the period of his pastorate were described. This period covered a very important era in the history of Salem, from 1783 to 1819.

Hon. J. G. **WATERS** narrated, in a very happy and graphic manner, many facts illustrative of the life, character and writings of the celebrated Dr. Bentley, whose name is held in great respect by all his old parishioners and their families, and who has an extensive reputation as a scholar and a theologian.

Mr. F. W. **PUTNAM** exhibited a stone pan and roller which were used by the natives in Central America to mash the corn. This was obtained by Mr. McNeill, who has recently returned from an expedition into that country, bringing a large and very valuable collection of specimens illustrative of its natural history and its archæology, forming a valuable addition to the Museum of the Peabody Academy of Science. Mr. P. made some interesting remarks in relation to this subject, and called the attention of the meeting to the important results of these investigations by Mr. McNeill.

LIST OF LETTERS RECEIVED

DURING THE YEAR 1868.

Agnew, Samuel, Philadelphia, Pa., Feb. 16; Akhurst, John, Brooklyn, N. Y., Apr. 18; Akklimatisations Verein in Berlin, Feb. 18; Allen, Anson, Orono, Me., Feb. 5; American Entomological Society, Feb. 1; Anthropological Society of London, Mar. 18; Atkins, Charles G., Augusta, Me., Dec. 24, 30, Feb. 28, Mar. 28, Apr. 3, May 15; Atkins, E. J., Augusta, Me., May 16; Atwood, N. E., Provincetown, Mar. 10, Boston, Mar. 18; Baird, S. F., Smithsonian Institution, Dec. 26, 28, May 20, June 22; Baker, Francis, South Danvers, Jan. 29; Banvard, Joseph, Paterson, N. J., Dec. 28; Barnard, Henry, Hartford, Conn., Dec. 23, 28, Jan. 1, 23, 27, Feb. 5, 26, Mar. 6; Bartlett, John, Haverhill, Apr. 27; Bell, S. D., Manchester, N. H., Apr. 30; Bertram, John, Salem, May 23; Bibliotheca Universitatis, Lugduno Batava, Oct. 22; Binney, W. G., Burlington, N. J., Mar. 18; Blake, W. P., New Haven, Conn., Jan. 27; Boardman, Samuel L., Augusta, Me., Feb. 5; Boll, Dr. E., Mecklenburg, Sept. 26; Bolles, Rev. E. C., Portland, Me., Jan. 2, 4, 10, Feb. 15, 22, Mar. 2, 3, Apr. 2, 3; Boston Society of Natural History, Mar. 27; Bosworth, Mrs. G. W., Lawrence, May 27; Breed, Dr. Mary E., Lynn, June 4; Brewster, C. G., Boston, Jan. 3; Brown, E. N., Boston, May 20; Brown, N., Boston, May 21; Brown, S. A., Salem, June 10; Buffalo Historical Society, Mar. 11; Burnham, W., Essex, Apr. 21; Bushnell, Charles J., New York, May 19; Buswell, E. W., Boston, May 5, 7; California Academy of Science, Jan. 13, 18; Challon, Howard, Philadelphia, Pa., Feb. 7; Mar., May 18; Chase, J. E., Holyoke, Jan. 23; Chicago Academy of Science, Feb. 28; Cloutman, W. R., Charleston, S. C., July 11; Codman & Shurtleff, Boston, Feb. 18; Cogswell, Miss E. G., Salem, June 23; Colburn, J., Boston, June 13; Colles, J. A. Purefoy, Officiating Curator of the Indian Museum, Calcutta, Apr. 16; Cook, Henry, Boston, Mar. 18; Cope, Prof. E. D., Philadelphia, Pa., May 29; Corporation of Yale College, Mar. 11; Cones, Dr. Elliott, Columbia, S. C., Apr. 3, 14, May 27, 28, June 1; Cowles, John, P., Ipswich, Mar. 17; Crosse, H., Paris, Sept. 1; Davis, Henry, McGregor, Iowa, Dec. 20, Feb. 6, May 26; Dawson, Henry B., Morrisania, N. Y., Dec. 27; Denslow, W. W., Inwood, N. Y., Feb. 11, 27; Die Gesellschaft Naturforschender Freunde zu Berlin, Feb. 7; Die Konigliche Gesellschaft der Wissenschaften zu Gottingen, Oct. 10; Die Naturhistorische Gesellschaft zu Hannover, Feb. 2; Dinwiddie, Robert, New York, June 1; Eaton, W. Winslow, Danvers, Jan. 20; Edwards, A. M., New York, Apr. 20; Faxon, Walter, Cambridge, Mar. 5; Felt, C. W., Salem, Jan. 24; Felt, John, Salem, May 12; Fowler, James, Richibucto, N. B., May 21, 29; Garrison, W. P., New York, May 27; Gilbert, G. K., Rochester, N. Y., Dec. 28; Gillis, J. A., Salem, May 15; Goodell, A. C., jr., Salem, Dec. 28, Feb. 4, May 15, 24; Gould, J. J., Wenham, Apr. 13; Green, Dr. S. A., Boston, Mar. 28; Hall, Prof. J., Albany, N. Y., Apr. 14, 16; Hanaford, Mrs. P. A., Reading, Mar. 17; Hart, Charles H., Philadelphia, Pa., Dec. 31; Hart, C. Fred, New York, Feb. 1; Haskell, J. P., Marblehead, Aug. 3; Henry, Prof. Joseph, Smithsonian Institution, May 2, June 1, 13; Higbee, Charles H., Salem, June 8; Higginson, T. W., Newport, R. I., Jan. 3; Holden, N. J., Salem, Aug. 5; Holland, A., Boston, Mar. 9; Holmes, John C., Ypsilanti, Mich., Feb. 6; How, Moses, Haverhill, Mar. 16; Howard, C. J., Mount Vernon, N. Y., Feb. 10; Howard, Winslow, J., West Swansey, N. H., Jan. 29; Howland, William, Lynn, Jan. 18; Hughes, D. Darwin, Marshall, Mich., Jan. 30; Institut National Genevois, Geneve, Nov. 17; Iowa Sec'y of the State of, Des Moines, Iowa, June 23; Iowa State Historical Society, Iowa City, Apr. 13; Jeffries, B. J., Boston, Apr. 13; Jefferis, W. W., West Chester, Pa., Feb. 3; Jillson, S., Hudson, Apr. 13; Johnson, D. C., Newburyport, May 11; Kaiserliche Akademie

der Wissenschaften in Wien, Nov. 12; Königliche Kaiserliche Zoologisch botanische Gesellschaft, Wien Nov. 29; Königliche Bayerische botanische Gesellschaft, Regensburg, Sept. 28; Lackey, A., Marblehead, Apr. 9; Atkinson, May 27; Lander, W. W., Salem, Aug. 3; Lea, Isaac, Philadelphia, Pa., May 7; Lewis, E. A. Batavia, N. Y., Feb. 4; Lord, Melvin, Boston, Dec. 27; Loring, Francis W., Boston, Feb. 29; Lowry, W., New York, May 21, 27; Lyceum of Natural History, New York, May 19, 20; Lynde, Miss Sarah A., Salem, June 22; Maine Historical Society, Feb., Mar.; Mann, Horace, Cambridge, Jan. 22; Manning, J. A., Salem, Apr. 2; Marsh, O. C., New Haven, Conn., Dec. 30, Feb. 12; Massachusetts Historical Society, Boston, Apr. 15; Massachusetts Institute of Technology, Boston, Jan. 27, May 20; McCoy, John F., New York, Mar. 3; Mead, S. B., Augusta, Ill., Apr. 10; Medical and Surgical Reporter, Philadelphia, Pa., May 5, June 20; Mercantile Library Association, Secretary of, New York, June 17; Miller, George D., Riverdale, N. Y., June 3; Milroy, John F., New York, May, 11; Minnesota Historical Society, Mar. 8; Moravian Society, Nazareth, Pa., May 6; Nation, New York, May 26; New Bedford Public Library, Feb. 3; New England Historic Genealogical Society, Mar. 10; New Jersey Historical Society, Mar. 15; New York State Library, Albany, Mar. 30; Nichols, Samuel R., Salem, July 28; Niven, James, Saugus, June; Norton, E., Farmington, Feb. 8; Noyes, Amos, Newburyport, Mar. 20; Oliver, J. E., Lynn, Mar. 26; Ordway, Albert, Richmond, Va., Apr. 18; Orton, James, Rochester, N. Y., May 1, 19; Osborn, C. S., Suspension Bridge, N. Y., Apr. 11; Peabody, S. E., Salem, May 15; Peirson, Jonathan, Schenectady, N. Y., May 12; Perkins, Benj. C., Salem, Jan. 16; Perkins, Henry C., Newburyport, Jan. 16, May 15; Phillips, R. Jr., Topsfield, July 13; Phippen, George D., Salem, May 16; Poe, Felipe, Havana, Cuba, Apr. 6; Poole, Isaac A., Chicago, Ill., Feb. 7, June 23; Preston, C. P., Danvers, Jan. 13, June 11; Putnam, W. E., Danvers, Jan. 2; Rantoul, R. S., Salem, Mar. 23; Reakirt, Tryon, Philadelphia, Pa., Apr. 4; Redwood Library, Librarian of, Newport, R. I., June 27; Reilly, P. T. O., Worcester, Feb. 8; Rice, Henry B., Boston, Oct. 16; Rice, Joseph W., Providence, R. I., Mar. 6; Richards, T. T., St. Louis, Mo., Apr. 10; Robinson, C., New York, Feb. 27; Robinson, John, Salem, Jan. 29; Rogers, William, B., Boston, Dec. 28; Royal Academy, Munich, Mar. 31; Rue, Charles B., Danvers, Jan. 17; Ruyster, H. M., New York, Jan. 31; Salisbury, J. H., Cleveland, O., Feb. 10; Sampson, Davenport & Co., Boston, Mar. 3; Sampson, George, Boston, Apr. 16; Scott, Andrew H., Saugus, June; Scudder, S. H., Boston, Mar. 10, 13; Secretary of State for Canada, Ottawa, Mar. 2; Shatswell, J. Augustus, Salem, June; Smith, Edward A., Jan. 20; Smith, Lizzie H., Salem, Mar. 30; Smith, Samuel H., Salem, Feb. 11; Smithsonian Institution, Dec. 11, Feb. 4, Apr. 18, May 18, 19; Snelling, S. G., Boston, July 10; Société Imperial des Naturalistes de Moscou, Nov. 4, 16; Society of Antiquaries of London, Nov. 25; Spooner, Thos., Reading, O., Jan. 20; Stimpson, Wm., Chicago, Ill., Mar. 13, 14; Stone, Edwin M., Providence, R. I., Aug. 4; Story, Norman, Essex, June 22; Swallow, G. C., Columbia, Mo., Jan. 6; Tellkamp, T. A., New York, Feb. 8; Tenny, S., Poughkeepsie, N. Y., Apr. 3; Tracy, C. M., Lynn, Jan. 29; Treadwell, E. W., Boston, Apr. 12, May 21; True, N. T., Bethel, Me., Jan. 7; Upton, Lucy H., Salem, Jan. 30; Veatch, Charles, Keyteville, Mo., Dec. 25; Venable, Edward, Paducah, Ky., Apr. 20; Victor Meunier, Paris, France, Oct. 29; Vose, George L., Paris, Me., Apr. 13; Wassell, J., Newburyport, May 12; Waters, J. Linton, Chicago, Ill., July 9, 31; Watt, David A. F., Montreal, Canada, Apr. 4, June 26; Wheeler, E. S., Savannah, Ga., Apr. 17, Berlin, N. Y., May 11; White, C. A., Iowa City, June 3; White, W. O., Keene, N. H., Mar. 18, 23; Whitmore, W. H., Boston, Jan. 25; Williams, Chauncy K., Rutland, Vt.; Wilson, John & Son, Cambridge, Jan. 2; Wood, Dr. H. C., Philadelphia, Pa., June 19; Woods, Thomas N., Rockport, June 10.

ADDITIONS TO THE LIBRARY FOR THE YEAR 1868.

BY DONATION.

AGASSIZ, Prof. LOUIS, of Cambridge. Illustrated Catalogue of the Museum of Comparative Zoölogy at Harvard College, Imp. 8vo. Cambridge, 1865.

ALMY, JAMES F., of Salem. Hymns for the Sanctuary, 1 vol. 8vo. Salem Directory and Almanac for 1850, 1 vol. 12mo, Salem. Boston Almanac for 1851, 1 vol. 12mo, Boston. Miscellaneous pamphlets, 7.

ANTIOCH COLLEGE. Catalogue of Officers and Students for 1867-68, 8vo. Yellow Springs, 1868.

APPLETON, WILLIAM F., of Boston. Memorial of the Cranes at Chilton, sm. 4to. Cambridge, 1868.

BAIRD, Prof. SPENCER F., of Washington, D. C. Discussion of the West India Cyclone, Oct. 29, 30, 1867, 8vo, pamph. Washington, 1868.

BAKER, NATHANIEL B., Adj. Gen. of the State of Iowa. Report of the Adjutant General of the State of Iowa, for the years 1863 to 1868, 8vo, 8 vols. Des Moines, 1863-1868.

BARNARD, HENRY, of Washington, D. C. Report of the Committee of the Department of Education, for 1867-68, 1 vol. 8vo. Washington, 1868.

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BERTRAM, JOHN, of Salem. Miscellaneous pamphlets, 45.

BOARDMAN, SAMUEL L., of Augusta, Me. Twelfth Annual Report of the Secretary of Maine Board of Agriculture, 1 vol. 8vo. Augusta, 1867. Agriculture and Industry of County of Kennebec, Maine, with Notes upon its History and Natural History, 8vo, pamph. Augusta, 1867. Legislative Documents, 13 numbers.

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BOLLES, Rev. E. C., of Portland, Me. Science-Gossip for 1867, 1 vol. 8vo. London. 1867. R. B. Thomas' Almanacs, 20 numbers. Mayor's Address and Annual Reports of the several departments in Portland, 8vo, pamph. Portland, 1868. Miscellaneous pamphlets, 64.

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BROOKS, HENRY M., of Salem. Sermon in North Church, Salem, Feb. 2, 1868, by Rev. E. B. Willson, 8vo, pamph. Salem, 1868. Miscellaneous pamphlets, 19.

BROOMALL, Hon. J. M., M. C. Life and Services of Gen. U. S. Grant, 8vo, pamph. Washington, 1868. Proceedings of the National Union Republican Convention, at Chicago, May 20, 31, 1868, 8vo, pamph.

BROWNE, Capt. ALBERT G., of Salem. Files of the National Era, 1848-1851, folio.

BUREAU OF REFUGEES. Fifth and Sixth Semi-Annual Reports on Schools for Freedmen, Jan. 1, July 1, 1868, 8vo, pamphlets. Washington, 1868.

BURNHAM, HORACE C., of Salem. New England Weekly Journal for Apr. 8, 1728. Boston Gazette, Mar. 12, 1770. New York Morning Post, Nov. 7, 1783.

BUSHNELL, CHARLES I., of New York. A Narrative of the Life and Adventures of Levi Hanford, 8vo, pamph. New York, 1863. Memoirs of Tarlton Brown, 8vo, pamph. New York, 1862. Journal of Solomon Nash, 8vo, pamph. New York, 1861. Narrative of John Blatchford, 8vo, pamph. New York, 1865.

BUTLER, Hon. B. F., M. C. Speech of H. Maynard in House of Representatives, Dec. 12, 1837, on Reconstructed Tennessee, 8vo, pamph., Washington, 1838. Speech of F. A. Pike in the House of Representatives, Dec. 17, 1837, on Taxing of National Bonds, 8vo, pamph., Washington, 1838. Speech of W. Lawrence in the House of Representatives, Dec. 13, 1837, on Impeachment of the President, 8vo, pamph., Washington. Speech of C. C. Washburne in the House of Representatives, Dec. 11, 1837, on the Purchase of Russian America, 8vo, pamph., Washington, 1837. Paine's Speech on Payment of Soldiers Bounties, Jan. 6, 1838, in U. S. Congress, 8vo, pamph. Stewart's Speech in U. S. Senate, Jan. 16, 1838, on the Bill to Establish a National School of Mines, 8vo, pamph. Broomall's Speech in the House of Representatives, Dec., 1837, on the National Finances, 8vo, pamph. Boutwell's Speech on Reconstruction, in the House of Representatives, Jan. 17, 1838, 8vo, pamph. Farnsworth's Speech on Reconstruction, in the House of Representatives, Jan. 15, 1838, 8vo, pamph. Judit's Speech in the House of Representatives, Feb., 1838, on Rights of American Citizens, 8vo, pamph. Report of the Special Committee of Revenue, Jan., 1838, 8vo, pamph., Washington, 1838. A Review of Jay Cooke's Financial Letter, 1838. Speeches of Hon. D. McCarty and Hon. S. M. Culum, in the House of Representatives, March 2, 1838, on Impeachment of the President, 8vo, pamph., Washington, 1838. Speeches of Hons. E. D. Washburn and G. S. Boutwell in the House of Representatives, Feb. 23, 1838, on Impeachment of the President, 8vo, pamph. Speeches of Hon. W. D. Kelley and J. A. Logan in the House of Representatives, Feb. 22, 1838, on Impeachment, 8vo, pamph. Speech of Hon. J. Harken in the U. S. Senate, Feb. 10, 1838, on Reconstruction, 8vo, pamph. Speech of Hon. B. F. Butler in the House of Representatives, Feb. 24, 1838, on Impeachment, 8vo, pamph. Speech of Hon. J. Lyon in the House of Representatives, March 7, on National Finances, 8vo, pamph. Speech of Hon. F. C. Beaman in the House of Representatives, Feb. 22, on Impeachment, 8vo, pamph. Speech of Hon. T. D. Elliot in the House of Representatives, March 11, on Freedmen's Bureau, 8vo, pamph. Speech of Hon. F. C. Beaman in the House of Representatives, March 18, on Reconstruction, 8vo, pamph. Speech of Hon. B. F. Butler in the House of Representatives, on Impeachment, 8vo, pamph. Speech of Hon. J. M. Broomall in the House of Representatives, March 18, 8vo, pamph. Speech of Hon. B. F. Butler in the House of Representatives, Apr. 16, on Impeachment, 8vo, pamph. Speech of Hon. Wm. Lawrence in the House of Representatives, Feb. 25, 8vo, pamph. Speech of Hon. F. A. Pike in the House of Representatives, May 7, American Shipping, 8vo, pamph. Speech of Hon. B. C. Cook in the House of Representatives, May 8, on Conflict between President and Congress, 8vo, pamph. Speech of Hon. W. D. Kelly in the House of Representatives, June 1, on Internal Revenue, 8vo, pamph. Speech of Hon. Charles Sumner in U. S. Senate, June 10, 8vo, pamph. Speech of Hon. R. C. Schenck in the House of Representatives, June 1, on Internal Tax, 8vo, pamph. Speech of Hon. O. Ferris in the House of Representatives, July 1, on the Purchase of Alaska, 8vo, pamph. Speech of Hon. B. F. Butler in the House of Representatives, July 14, 8vo, pamph. Speech of Hon. J. A. Logan in the House of Representatives, July 16, on the Democratic Party, 8vo, pamph. Congressional Globe and Appendix, 1st session 40th Congress, 1 vol. 4to, 1837. Message and Documents, 1837-38, abridgement, 1 vol. 8vo, Washington, 1837. Paris Universal Exposition, 1857, 8vo, Washington, 1838. Argument of G. S. Boutwell in the U. S. Senate, Apr. 23, 23, 8vo, Washington, 1838. Argument of Thos. Williams in the U. S. Senate, Apr. 27, 1838, on the Trial of A. Johnson. Message and Documents, War Dep't, 1837-38, 2 vols. 8vo, Washington, 1837. Argument of J. Bingham before the U. S. Senate, at the Trial of A. Johnson, May 4, 5, 6, 1838, 8vo, pamph., Washington, 1838. Internal Tax Bill in the U. S. House of Representatives, May 12, 1838, 8vo, pamph. Mr. Elliot's Report from the Committee on Freedmen's Affairs, 8vo, pamph. Monthly

Reports of the Department of Agriculture for April, May and June, 1868, 8vo, pamph., Washington, 1868. Report on the Mineral Resources of the U. S., 1 vol. 8vo, Washington, 1838. Mr. Banks' Report on the "Treaty with Russia," 8vo, pamph. Butler's Report, Raising of Money to be used in Impeachment, 8vo, pamph., 1868. Tariff Bill in U. S. House of Representatives, July 1, 1868, 8vo, pamph. Internal Tax Laws, 8vo, pamph. Report submitted to U. S. House of Representatives, June, 1868, by Mr. Morrill of Penn., 8vo, Washington, 1868. Impeachment of A. Johnson, 3 vols. 8vo, Washington, 1868. Message and Documents for 187-68, 2 vols. 8vo, Washington, 1868.

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CHENEY, T. APOLEON, of Havana, N. Y. Historical Sketch of the Chemung Valley, 8vo, pamph., Watkins, N. Y., 1868.

CHKW, R. S., U. S. Department of State. The Production of Iron and Steel in its Economic and Social Relations, 8vo, pamph., Washington, 1868.

CHOATE, DR. GEORGE, of Salem. Medical Repository, 1st Decade 6 vols. 8vo. 2nd Decade, 6 vols. 8vo. 3rd Decade, 1 vol. 8vo, New York, 1798 to 1810. Smellie's Midwifery, 3 vols. 8vo, London, 1763. Dewee's Treatise on Diseases of Females, 1 vol. 8vo, Phila., 1831. Burns' Midwifery, 1 vol. 8vo, New York, 1810. Denman's Midwifery, 1 vol. 8vo, New York, 1821. Thomas' Practice of Physic, 1 vol. 8vo, New York, 1822. London Practice of Midwifery, 1 vol. 8vo, Concord, 1836. Thacher's Modern Practice, 1 vol. 8vo, Boston, 1817. Tytler on Plague and Yellow Fever, 1 vol. 8vo, Salem, 1799. Mann's Medical Sketches, 1 vol. 8vo, Dedham, 1816. Began's Therapeutics, 1 vol. 8vo, New York, 1829. Morgan's Practice of Physick, 1 vol. 8vo, London, 1735. Cullen's Clinical Lectures, 1 vol. 8vo, London, 1797. Bateman's Synopsis of Cutaneous Diseases, 1 vol. 8vo, Phila., 1824. Memoir of James Jackson, Jr., M.D., 1 vol., 8vo, Boston, 1835. Burns on Inflammation, 1 vol. 8vo, Albany, 1812. Pharmacopœia of U. S. A., 1 vol. 8vo, Boston, 1820. Murray's Materia Medica, 1 vol. 8vo, Phila., 1808. Eberle's Materia Medica, 2 vols. 8vo, Phila., 1825. Bigelow's Sequel to Pharmacopœia of U. S. A., 1 vol. 8vo, Boston, 1823. Thacher's American New Dispensatory, 1 vol. 8vo, Boston. Pharmacopœia Batrana, 12mo, 1 vol. London, 1698. New York Medical Journal, 3 vols. 8vo, New York, 1809, '10, '11. London Medical Journal, vols. 8, 9, 8vo, London, 1787, '88. New London Medical Journal, 1 vol. 8vo, London, 1792. Eclectic Repertory, 10 vols. 8vo, Phila., 1811-1820. American Medical Recorder, 3 vols. 8vo, Phila., 1819, '20, '22. American Medical Review, 2 vols. 8vo, Phila., 1825, '26. Medico Chirurgical Review, 14 vols. 8vo, New York, 1828-1833, 1842 and '43. Williams Medical Biography, 1 vol. 8vo, Greenfield, 1815. Transactions of American Medical Association, 9 vols. 8vo, Phila., 1848, etc. Blackall on Dropsies, 1 vol. 8vo, Phila., 1820. Medical Clinic, 1 vol. 8vo, Phila., 1838. Rush's Lectures, 1 vol. 8vo, Phila., 1811. Paris' Pharmacologia, 8vo, New York, 1825. Report of Portsmouth Relief Association, 1 vol. 8vo, Richmond, 1856. Numa Pompilius secund Roi de Rome par Florian, 12mo, Paris, 1820. Report on Spasmodic Cholera, 1 vol. 8vo, Boston, 1832. Sequel to "First Lessons in Latin," 12mo, Boston, 1834. North's, Treatise on Spotted Fever, 8vo., New York, 1811. View of the Science of Life, 1 vol. 8vo. Gazetteer of the U. S., 1. vol. 8vo, Hartford, 1833. Mitchell's Reference Map of U. S., 8vo, Phila., 1834. Currier's Political Text Book, 8vo, Holliston, 1841. Smith's Dissertation upon the Nerves, 8vo, London, 1768. Edwards against Channey, 12mo, Boston, 1824. Palfrey's Sermons, 1 vol. 8vo, Boston, 1834. Heeren's Researches on Ancient Greece, 1 vol. 8vo, Boston, 1842. Bichat on Pathology, 1 vol. 8vo, Phila., 1827. Spear on Capital Punishment, 12mo, Boston, 1844. Anatomist's Vade-Mecum, 12mo, Boston, 1801. Corvisart's Essay on the Heart, 8vo, Boston, 1812. Select Medico-Chirurgical Transactions, 8vo, 1830. Gardner's Observations on

Animal Economy, 1 vol. 8vo, Edinburgh, 1784. *Soudamore's Treatise on Gout and Rheumatism*, 1 vol. 8vo, Phila., 1819. *Brodie on the Joints*, 1 vol. 8vo, Phila., 1821. *Good's Study of Medicine*, 5 vols. 8vo, Boston, 1826. *Chisholm's Essay on Malignant Pestilential Fever*, 1 vol. 8vo, Phila., 1799. *Fordyce on Fever*, 2 vols. 8vo, London, 1794, 1798. *Boyer on the Bones*, 8vo, Phila., 1805. *Darwin's Temple of Nature*, 1 vol. 8vo, New York, 1804. *Hey's Surgery*, 1 vol. 8vo, Phila., 1805. *Abernethy's Lectures on Surgery*, 1 vol. 8vo, 1830. *Marcy's Exploration of the Red River*, 8vo, Washington, 1854. *Edrehl's Account of the River Sambatyan*, 1 vol. 8vo, London, 1855. *By-Laws and Orders of Massachusetts Medical Society*, 8vo, Boston, 1850. *Smith's Essay on Typhous Fever*, 8vo, New York, 1824. *Report on Spasmodic Cholera*, 8vo, Boston, 1832. *Teale on Neuralgic Diseases*, 8vo, Phila., 1830. *Fordyce's Five Dissertations on Fever*, 8vo, Boston, 1815. *Smellie's Philosophy of Natural History*, 8vo, Dover, 1808. *Armstrong on Fevers, Consumption, etc.*, 8vo, Hartford, 1823. *Barnard's Tribute to Gallaudet*, 8vo, New York, 1869. *Illustrations of Pulmonary Consumption*, 8vo, Phila., 1834. *Williamson on Climate*, 8vo, New York, 1811. *Armstrong on Typhus Fever*, 8vo, Phila., 1821. *Desault's Surgery*, 2 vols. 8vo, Phila., 1814. *Mass. Medical Society Communications*, 6 vols. 8vo, London, 1790, etc. *Library of Practical Medicine*, 3 vols. 8vo, Boston, 1842, etc. *Hitchcock's Report on Geology, Mineralogy, Botany and Zoölogy*, 1 vol. 8vo, Amherst, 1833. *Copeland's Medical Dictionary*, 4 vols. 8vo, Boston, 1834, etc. *Beaumont on the Gastric Juice*, 1 vol. 8vo, Boston, 1834. *Cabanis Essay on the Certainty of Medicine*, 8vo, Phila., 1823. *Burlingame on Laws*, 2 vols. 8vo, Cambridge, 1807. *Dyspepsy, Forestalled and Resisted*, 8vo, Amherst, 1830. *The American Herbal*, 12mo, Walpole, 1801. *Huxham on Fevers*, 8vo, Lond., 1767. *Home on Ulcers*, 12mo, Phila., 1811. *Brown's Elements of Medicine*, 12mo, Fairhaven, 1797. *Chase on Radical Cure of Hernia*, 1 vol. 8vo, Phila., 1836. *Smith & Tweedie on Fever*, 1 vol. 8vo, Boston, 1831. *Pearson's Surgery*, 1 vol. 8vo, Boston, 1832. *MacKenzie on Diseases of the Eye*, 1 vol. 8vo, Boston, 1833. *Green on Diseases of the Skin*, 1 vol. 8vo, Boston, 1839. *Dissertations on Direct Exploration*, 1 vol. 8vo, Boston, 1836. *Dr. Sewall's Lectures on Phrenology*, 1 vol. 8vo, Washington, 1837. *Rush's Medical Observations*, 1 vol. 8vo, Phila., 1798. *Currie on Fevers and other Diseases*, 1 vol. 8vo, 1811. *Shattuck's Dissertations*, 1 vol. 8vo, Boston, 1808. *Faithhorn on Liver*, 1 vol. 8vo, London, 1818. *Gardner's Abridgement of Leverett's Lexicon*, 1 vol. 8vo, Boston, 1840. *Channing on Slavery*, 1 vol. 12mo, Boston, 1835. *Pharmacopœia of U. S.*, 1 vol. 8vo, Boston, 1820. *Alcott on Vegetable Diet*, 1 vol. Boston, 1838. *Worcester's Fourth Reading Book*, 1 vol. 8vo, Boston, 1839. *Spirit Manifestations Examined and Explained* 1 vol. 8vo, New York. *Jackson's Syllabus of Lectures at Massachusetts Medical College*, 8vo, 1 vol. *Principles of Health*, 2 vols. 8vo, Baltimore, 1819. *Philip on Indigestion*, 1 vol. 8vo, Phila., 1822. *Formulary for Employment of New Medicines*, 1 vol. 8vo, New York, 1823. *Murray's English Exercises*, 16mo, Boston, 1836. *Dissector's Guide, or Student's Companion*, 8vo, Boston, 1833. *Christian Examiner*, 24 vols. *School Journal*, 12 vols. *Monthly Journal*, 13 vols. *Monthly Miscellany*, 36 Nos. *Monthly Religious Magazine*, 158 Nos. *College pamphlets*, 69. *Mass. Medical Society pamphlets*, 49. *Boston Almanacs*, 21. *Salem Directory*, 9 vols. *Miscellaneous pamphlets*, 350.

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Feb., March, 1866. Files of the New York Ledger, Mar., Apr., May, 1866. Several numbers of the New York Mercury.

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COX, P. L., of Lynn. Several numbers of Lynn Reporter to complete early volumes.

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CUMMINGS, WILLIAM. A Three-Dollar Bill of Continental Currency.

DANIELS, G. P., Salem. Cicada from Salem.

DODGE, A. JUDSON, Danvers. Fossil Coral from Illinois.

DODGE, ALLEN W., Hamilton. A specimen of *Eudryas grata* from the Grapevine, taken in Hamilton.

DODGE, J. S., Beverly. A Stone Pestle found in Lynn.

FELLOW, T. J., Salem. The smaller Claw of a Lobster, *Homarus Americanus*. The Claw weighed four pounds. The Lobster was taken at Cape Porpoise, Maine, and weighed fifty-one pounds.

FISKE, Capt. —. Specimen of Vicar of Wakefield Pear raised in California and brought here around Cape Horn.

GOLDTHWAIT, J. A., Salem. Specimen of *Epiera diadema* from Salem.

GOODELL, A. C., Jr., Salem. Two pieces of Cast Iron made at Saugus from *Bog Iron* found at that place.

GOODHUE, B., Hancock, N. H. Five Black Rats from Hancock.

GOODHUE, WM. Skull and portions of Human Skeleton from Zanzibar.

Goss, F. P., Salem. An Old-fashioned Bit Stock.

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GOULD, Z., Topsfield. A Stone Gouge from Topsfield.

HALL, Prof. JAMES, Albany, N. Y. A collection of Fossils consisting of one hundred species, three hundred specimens, from the Niagara, Hamilton and Tully Limestone and Chemung Group, in New York and Indiana.

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HOOPER, N. Specimens of Copal from the West Coast of Africa.

HUING, WM. PRESCOTT, Salem. Dragon Fly taken in Salem.

HUNT, T. FRANK, Salem. A series of the New Silver Hong Kong Currency of the denomination of one dollar, twenty, ten and five cents, and one cent copper.

HURCHINSON, Capt. DANIEL, Salem. Specimens of *Euplectella aspergillum*; Venus Flower Basket from the Island of Zebu, Philippine Islands.

IVES, JOHN M., Salem. Four Eggs of Gull from the Outer Gooseberry, Salem Harbor.

JACKSON, Dr. J. B. S., Boston. Four specimens of Flying Fish.

JOHNSON, C. W., Salem. Larvæ of *Thyreus*, from the Grape-vine.

JOHNSON EDWIN G. A. "Double Tournois," a French Copper Coin of Louis XIII, date 1639—dug up near the Horse Railroad office in Salem, May, 1868.

JONES, G. W., Salem. A specimen of *Ampellis cedrorum* from the vicinity of Salem, and Insects from Africa.

KIMBALL, JAMES, Salem. Specimens of *Belostoma* from Coy's Pond, Beverly; a Stone Adze and Nest and Eggs of the Chickadee from unknown locality; Eggs of *Pyrula* from Cape Cod; and two Moths from vicinity of Salem.

KIMBALL, Miss MARY. A Longicorn Beetle from Columbus, Ga.

LAMSON, J. ARTHUR, Topsfield. A Stone Gouge, small Axe and a Sinker found in Topsfield.

LANDER, W. W., Salem. A specimen of *Clytus* sp. taken in Salem.

LOCK, N. C. Specimen of *Nyctiardea Gardenii* shot in Salem.

LOUD, J., Salem. Deer Mouse, taken in Broad street, Salem.

LUNGREN, Mrs. Dr. HENRY, Volusia, Fla. (through Miss M. G. WHEATLAND, Salem). Head, Feet, Wings and Tail of *Picus pileatus*. Three Heads of the Florida Parrot, and a specimen of *Æschna* sp. from St. Augustine, Fla.

MACK, DAVID, Jr., Salem. Three specimens of *Cyprea* sp. from Ceylon.

MACK, Dr. WILLIAM, Salem. Fossils from Trenton Falls, and Sharon Springs; Salamander, Fishes, Mollusks and Insects from Sharon Springs; Reptiles and Insects from Aiken, S. C., and a specimen of *Lycosa* sp. found in Salem; also Minerals from various localities.

MACK, Miss HARRIET O., Salem. Fruit of the Tamarind from South Carolina, and Larvæ of *Philampelus* sp.

MANNING, ROBERT, Salem. Eleven specimens of Minerals from Caldere, Chill.

MANNING, J. H. A portion of Corwin Rock in Boston Harbor.

MARGOLLES, F., Salem. Fine specimens of Carbonate of Lime from El Templo Grotto, Cuba; Reptiles and Insects from Cuba.

MAYO, E. R., Boston. Specimen of *Condylura cristata* from Boston.

MCGRANE, WM., Salem. Dragon-fly taken in Salem.

MEADY, Mr., Salem. Caterpillar of the Hawk Moth.

MILBURN, Mrs. JANE, New York. Alcoholic specimens of Locust from Aspinwall.

MOODY, HENRY D. Bowl of a very old Spoon found between the outer boards and the mop-boards in the old building where Mr. Webster kept a hat store on Washington street, taken down at the building of the Tunnel.

MORSE, WILLARD S., Ware, Mass. Case of the Cadis Worm, *Phryganea* sp. from Ware, Mass.

MUSEUM OF YALE COLLEGE, New Haven, Conn. Forty-six specimens of Shells from various localities.

NEILSON, Dr. WM., Salem. Pieces of Wood from the Frigates Congress and Merrimac.

NEWHALL, S., Saugus Centre. A Stone Axe found in that place.

NICHOLS, C. F., Salem. A collection of Insects.

NICHOLS, F. W., Salem. Thirty species of Insects from Washington, D. C., and a twig containing Eggs of the Seventeen-year Locust.

NICHOLS, Mrs. GEORGE, Salem. Portion of a Stone Pestle found in the vicinity of Salem.

NICHOLS, WM. H., 3d. A small slab of White Marble with lines cut around and across it, found on a seat in a Church in Senafe, Abyssinia, by Lieut. William Mackie, 2d Queen's Royal Regiment, during the late war in that country.

OSBORNE, LEWIS S., Salem. Imago and pupa of the Seventeen-year Locust.

OSGOOD, CHARLES C., Salem. Specimens of the Jute Plant.

OSGOOD, Miss HATTIE, and PIERSON, Miss DAISEY, Salem. Specimens of Woolly Larvæ of a Saw-fly found on the Butternut Tree, taken in Salem.

PAINE, J. A., Salem. A Stone Pestle having a groove cut around it at one end, and portions of Bones of various Animals, found in a Shellheap at Pine Grove.

Specimen of *Sphinx quinquemaculata*, taken in Salem, and a piece of Fossil Wood from unknown locality.

PAGE, Miss ANNIE L., Danvers. Spider from that place.

PALFREY, C. W., Salem. Two Eggs of Mocking-bird, laid in a cage. Samples of Cloth from the Society Islands.

PEABODY, ALFRED S., Cape Town, C. G. H. Skull of Wild Boar; Horns of two species of Antelope; Eggs of Albatros and King Penguin, and two Botanical specimens, all from the Cape of Good Hope.

PERLEY, Miss Mary E., Topsfield. A Longicorn Beetle from Topsfield.

PERLEY, THOMAS W., Topsfield. Insects from Topsfield.

PERRY, Mr., Danvers. Specimens of Eagles imperialis.

PHIPPEN, G. D., Salem. An Indian Stone Implement from —.

POLLARD, GEO. A. Stone from a Temple at Ninevah, bearing inscription.

POUSLAND, GEO. W., Salem. Two specimens of Kryolite from Greenland, with Labradorite, Yellow Copper Pyrites, Galena and some Iron Pyrites.

PRICE, Mr., Manchester. A Holothurian from near Baker's Island, Salem Harbor.

PULSIFER, DAVID, Boston. The Dress of an Indian Chief from California, made from the Intestines of the Seal.

PUTNAM, Mrs. EBEN, Salem. Several Insects from vicinity of Salem.

PUTNAM, JOHN, Salem. A dried specimen of Holothurian.

RAMSDALL, F. G., Marblehead. Portion of a Stone Gouge found at Marblehead.

REED, Mr., Salem. A curiously shaped Radish.

ROBERTS, DAVID, Salem (by request). An Oil Portrait of himself.

ROBERTS, Miss E. K., Salem. Specimen of Corydalis from the vicinity of Salem.

ROBERTS, Mr. Red-shouldered Hawk killed in Salem.

ROBINSON, JOHN, Salem. Specimens of Corals from various localities; Arrow-heads from Fort Ticonderoga, Eastern Virginia, Andover and Salem; Cells of the Tailor Bee from Farmington.

ROSES, JOSEPH. Sketch of the old Capen House at Topsfield.

RUSSELL, S. S. C., Boston. Shells and fragments of Coral from the Harbor of Havana, Cuba.

SALTONSTALL, Miss CAROLINE, Salem. An Ancient Mirror and Dish belonging to the Leverett family.

SCOTT, A. D., Salem. Specimen of *Actias luna* taken in Salem, June 20.

SEARS, J. H., Danvers. Specimen of *Buteo lineatus* shot in Danvers, and Eggs of the same; also specimens of *Julus* sp. and of *Helix alternata* from Danvers.

SHATSWELL, JOS., Salem. Egg of Black Spanish Hen, weighing 3½ oz.

SHELDON, AUGUSTUS, Salem. Insects from vicinity of Salem.

SHEPARD, HENRY F., Salem. Copal from the East Coast of Africa; also Fossils from various localities; two specimens of *Cassia* from Zanzibar?, and a specimen of Oxide of Iron from the Island of Elba; Head of Fox from vicinity of Salem; *Turdus migratorius*, having a curious malformation of the Upper Mandible; three Heads of *Bonasa umbellus* from New Hampshire; two Fire Buckets used by his father, Michael Shepard, bearing the date 1783.

SHEPARD, S. A. D., Boston. Alcoholic specimens of Reptiles and Insects from various localities.

SILSBEE, WM., Salem. Java Sparrow; two specimens of Lolligo from Salem Harbor.

SILVER, Miss MINNIE, Salem. Specimen of *Oryzias* sp. with its Eggs, from Rowley.

SIMONDS, G. W., Salem. Cicada septemdecem from Fallstown, Md.

SMITH, L. P. Section of the Trunk of a Palmetto Tree from Paradise Island, Wondo River, S. C.; also section of a Fig Tree from same place.

SMITHSONIAN INSTITUTION, Washington, D. C. Nineteen specimens of Birds, consisting of eleven genera seventeen species from Lower California, Mexico, Central America, West Indies and Brazil.

STRILEY, JACOB, Salem. Four malformed Claws of *Homarus Americanus* from Salem Harbor.

STORY, NOAH, Essex. Stone Arrowhead and Gouge found at Essex.

TEAGUE, Mr., Salem. Malformed Egg of Common Fowl.

TORZ, JOHN H. Model of an Esquimau Kyak.

TUCKER, SAMUEL, Salem. Malformed Claw of *Homarus Americanus* from Salem Harbor.

TURNER, L. P. H., Danvers. Two living specimens of *Atacus Cecropia*, female, from Danvers.

TUTTLE, F. W. Salem. Two specimens of Black Rat, from Hancock, N. H.

UPTON, HENRY. Pieces of a Stalactite from the Cave of De Belamar at Matanzas, Cuba.

WARD, ANNIE GOODHUE, Salem. Case of *Phrygania* sp. from Ware, Mass.

WARD, J. L., Salem. Two specimens of *Sygnathus* from Collins' Cove, Salem.

WATERS, D. P. Salem. Specimen of *Prionus* taken in Salem.

WEBB, W. G., Salem. Specimens of Coleoptera from Pompeii and Naples.

WHEATLAND, Dr. H., Salem. Specimen of *Dytiscus marginalis* from Salem.

WHEATLAND, Miss M. G., Salem. Larva and Pupa of a Beetle allied to *Cassida*, found on the Raspberry, in Salem, and four specimens of *Gorgonia* from Florida.

WILKINS, JOSEPH, Salem. A Longicorn Beetle taken in Salem.

COMMUNICATIONS
OF THE
ESSEX INSTITUTE.

VOL. VI. 1867-70.

ISSUED IN

TWO PARTS WITH THE PROCEEDINGS.



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COMMUNICATIONS.

- I. EDWARD NORTON. Description of Mexican Ants noticed in the American Naturalist, April, 1868. Illustrated by 11 cuts. [Communicated April 6, 1868. Author's copies issued July, 1868. Regular issue, March, 1870]. pp. 1-10.
- II. HORATIO C. WOOD, Jr. On the Phalanges of the United States of America. Illustrated by 16 cuts. [Communicated Dec. 9, 1867. Author's copies issued Aug., 1868. Regular issue, March, 1870]. pp. 10-40.
- III. A. S. PACKARD, Jr. On Insects Inhabiting Salt Water. Illustrated by 6 cuts. [Communicated Dec. 7, 1867. Author's copies issued April, 1869. Regular issue, March, 1870]. pp. 41-51.
- IV. A. E. VERRILL. Synopsis of the Polyps and Corals of the North Pacific Exploring Expedition, under Commodore C. Ringgold and Capt. John Rogers, U. S. N., from 1853 to 1856. Collected by Dr. Wm. Stimpson, Naturalist to the Expedition. Part IV, Actinaria. Illustrated by 2 plates. [Concluded from Vol. V, p. 330, etc. Author's copies issued Nov., 1869. Regular issue, March, 1870]. pp. 51-104. Plates. 1-2.
- V. HORACE MANN. Flora of the Hawaiian Islands. [Concluded from Vol. V, p. 248. See Editorial Note on p. 112. Regular issue March, 1871]. pp. 105-112.
- VI. T. MARTIN TRIPPE. Notes on the Birds of Minnesota. [Communicated Jan., 1871. Regular issue, March, 1871]. pp. 118-119.
- VII. R. T. KNIGHT. Note on the Earth Worm. [Communicated 1870. Regular issue March, 1871]. p. 120.
- VIII. THEODORE GILL. Synopsis of the Primary Subdivisions of the Cetaceans. [Communicated December, 1870. Author's copies and Regular issue, March, 1871]. pp. 121-127.
- IX. ELLIOTT COUES. On the Myology of the Ornithorhynchus. [Communicated December, 1870. Author's copies and regular issue, May, 1871]. pp. 128-178.

NOTICE.

With this volume of the PROCEEDINGS AND COMMUNICATIONS OF THE ESSEX INSTITUTE the publication is brought to a close.

The proceedings at the meetings of the Institute since the close of the year 1868 have been published in the monthly BULLETIN of the Institute, in which journal the communications made at the meetings have also been printed in full or by abstract.

The Bulletin of the Institute is a monthly sheet of about 16 pages and is distributed free to members, or mailed to any address on the receipt of the subscription of \$1.00 per annum. — EDITOR.

COMMUNICATIONS
OF THE
ESSEX INSTITUTE.
VOL. VI.

I. *Description of Mexican Ants noticed in the American Naturalist, April, 1868.*

BY EDWARD NORTON.

[Communicated April 6, 1868.]

Camponotus (Formica) esuriens Smith.

SMITH, British Museum Catalogue. Hymenoptera. VI, p. 54, No. 196, 1858. Major and minor workers. Mexico.

Mr. Smith describes the two workers. I find among my specimens the worker major, the male, and female.

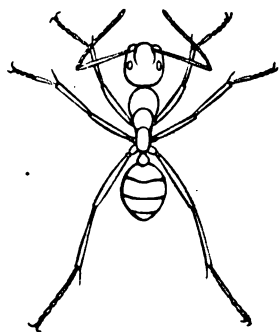
The worker major agrees with Mr. Smith's description; the ocelli are wanting.

Female. Length, 0.50 in. Face below ocelli black; the radicle of antennæ, lower margin of face, and greater part of mandibles ferruginous; mesothorax and scutellum with variable piceous, or pitch-colored spots. Declivity of metathorax abrupt; node depressed, almost truncate above; abdomen black; wings hyaline; veins ferruginous.

Male. Length, 0.28–32 in. The head, mesothorax, and abdomen piceous black. Nasus, remainder of thorax, node, and legs piceous; trochanters yellowish. Node truncate, slightly emarginate; ocelli prominent and separated.

Camponotus (F.) fulvaceus Norton (nov. sp.).

Worker major. Length, 0.30–32 in. Color ochreyellow. Scape black; flagellum, mandibles, a band near the apex of each segment of abdomen, and the legs below the apex of femora piceous. Apex of antennæ yellowish. A carina down the nasus; ocelli wanting. Head subquadrate, slightly hollowed behind. Thorax compressed behind, declivity not abrupt; node rounded, moderate. Body covered with long, scattered, pale hairs. The head is somewhat wider than the thorax.



Worker minor. Length, 0.30 in. The head of this form is nearly as large, but is slenderer, and is more rounded behind the eyes. (Four major workers; two minor workers.)

Camponotus (F.) nitidus Norton (nov. sp.).

Worker. Length, 0.25 in. Piceous black, slender, polished, shining. Antennæ ferruginous, each set in a larger basin near to a very short inner carina or ridge; nasus not distinctly carinate, with a deep hollow on each side at base of mandibles; a slender impressed line down the middle of face. Mandibles striate, rufous. Head about one-third wider than thorax, not emarginate behind. Thorax compressed, declivity abrupt; node rounded, flat behind. Abdomen polished, margin of segments pale, legs rufous. A few scattered hairs on the face, none on the body. (Three workers.)

In this and the next, the legs are not as long as in the two previous species.

Camponotus (F.) nacerdus Norton (nov. sp.).

Worker. Length, 0.22. Dull black; the face below the antennæ rufous. The whole body slender, dull black,

with delicate punctures. (Antennæ wanting.) Head subquadrate, hardly emarginate and truncate behind, corners distant. Eyes subovate, small. Face not rugose; a distinct ridge down the nasus, continuing an impressed line above. The whole face below the antennæ rufous. Thorax compressed behind; node rounded, not thickened, flattened behind. Abdomen dull black, covered with a silky pile, visible in certain lights. Head and body with a few scattered long hairs. Legs piceous black, the anterior larger than the others. (Two workers.)

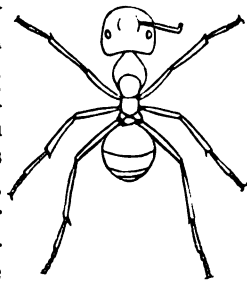
This is somewhat like the *F. corusca* of Smith.

Camponotus (Tapinoma) piceatus Norton (nov. sp.).

Worker major. Length, 0.20 in. Color entirely reddish piceous. Antennæ pale. A carina on the nasus, an impressed line above. Head one half wider than thorax, square, not hollowed behind, and, with the thorax, dull with delicate punctures. Thorax compressed behind, declivity abrupt, incisures distinct. Node rounded, convex behind, so as to fit closely into the concavity of abdomen. Abdomen shining, not polished, base of segments darker, apex narrowly margined with pale gold. Body covered with sparse whitish hair. Legs shorter than in those of the previous genus. (Five workers.)

Camponotus (T.) tomentosus Norton (nov. sp.).

Worker major. Length, 0.28 in. Dull blackish, with ferruginous tints; the abdomen sericeous, with a greenish pile. Head quadrate, large, nearly twice as wide as abdomen, dull, with dense fine punctures; eyes small, subovate; antennæ black, inserted beneath the raised inner carina which partly overlaps the radicle; nasus hardly carinate; mandibles wide, with about three inner teeth, outer tooth sharp. Thorax narrowed behind, faintly ferruginous. Node rounded, slightly convex behind, rather large. Abdomen black, the apical margins of segments narrowly polished, golden, the node and abdomen closely covered with shin-

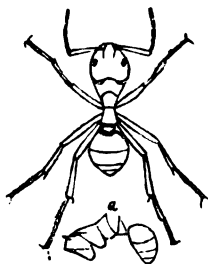


ing yellowish green hair. Legs black, and with the body sparsely covered with short pale erect hair.

Worker minor. Length, 0.22 in. The head about half the size of the preceding, slightly wider than thorax, somewhat rounded and scarcely emarginate behind; mandibles formed as in the major workers, but not so wide. (Four majors; three minor workers.)

***Polyrhachis arboricola* Norton (nov. sp.).**

Worker major. Length, 0.20 in. Color dull black; form short and stout. Head nearly twice as wide as thorax, deeply emarginate behind, distinctly and closely punctured; eyes round. Antennæ inserted below the line of eyes; joints of flagellum incised, basal radicle and flagellum ferruginous. Thorax with a strong spine on each side before, middle lobe prominent, quadrate, with distinct edges; metathorax subtriangulate, widest behind, with sharp angulate corners, but no spines, abrupt on all sides.



Node oval, emarginate, with one sharp spine on the summit. Abdomen almost round, covered with abundant silky hair, the whole body with long whitish hair. Anterior legs below the knees piceous.

***Polyrhachis strigata* Norton (nov. sp.).**

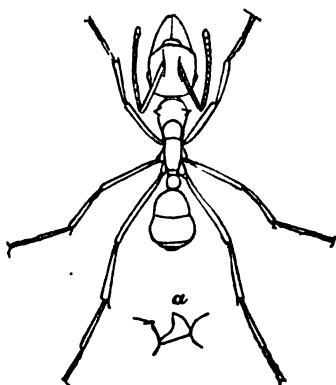
Worker major. Length, 0.16 inch. Color black, the antennæ and legs honey-yellow. Antennæ inserted low down the face, widely separated. Head rounded behind; eyes round. Mandibles rufous, triangular. Thorax ovate, contraction behind gradual, separation of lobes indistinct. Node nearly spherical; basal segment of abdomen as long and wide as the next. The whole body from nasus to anal segment covered with coarse longitudinal striæ; they pass around the node, the circles diminishing to the summit. Legs short, pale at joints; femora and tibiæ swelled in middle.

Var. Color wholly ferruginous. The antennæ and legs honey-yellow.

Ectatomma ferrugineus Norton (nov. sp.).

Worker major. Length, 0.40 in. Color ferruginous; mandibles yellowish. Eyes round, widely separated.

Head longitudinally rugose, basin of antennæ very large, touching the eyes and extending to top of head; three carinæ between the antennæ, down the face; between these, over the insertion of antennæ are two shining tubercles. Mandibles with fine striæ. Head transverse behind. Thorax advanced, with a sort of tubercle before, and a short stout spine at each corner;



scutum large and circular, with two tubercles on each side, one on mesothorax, and one on the adjoining piece, or parapsides; two short separated spines on the declivity of metathorax; the pro and mesothorax with circular and longitudinal, the remainder with transverse coarse striæ. Node subquadrate, prominent before, truncate above, with circular striæ; first segment canaliculate through the middle, with delicate diverging striæ; a deep incision between this and the next segment, which is covered with very fine diverging striæ; apex of following segments shining. Hinder tibiæ and tarsi each one-third longer than those preceding; claws with a small inner tooth near the middle.

Male. Length, 0.40 in. Color piceous, varying to black. Antennæ set in a line with the bottom of eyes, the summit of the basin in a line with top of eyes; scape short, about half as long as third article. Back of head truncate, about one-third narrower than at eyes. Prothorax distinct. Mesothorax trilobate as in *Tenthredo*, rounded before, thorax with numerous longitudinal striæ, running (seen from behind) from the right down to the left side. Node rounded, transversely striate, with a short spine on each side before. Abdomen as in the

workers, the striæ finer and remaining segments delicately punctured. The whole body more or less sericeous with fine whitish hair. Wings as in *E. tuberculata*. Claws bifid. (Four workers, one male.)

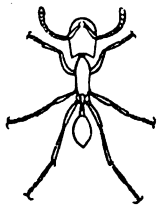
***Eciton brunnea* Norton (nov. sp.).**

Worker minor. Length, 0.37 in. Color of head and thorax black, metathorax indistinctly ferruginous. Abdomen and legs from honey-yellow to ferruginous. Head narrower and mandibles broader than in *E. Mexicana*. Eyes rather larger. Basin of antennæ surrounded by a carinæ, except on upper side; an impressed line down the face. Mandibles with a distinct inner tooth, and their basal half finely denticulate. Head narrowed behind, with a short bent spine on back of the hinder angles. A distinct flattened space with subangulate margin down the thorax, ending in middle of metathorax in two spines; a single sharp spine beneath first node bent backwards, and a tooth on apex of second node beneath pointing forward. Abdomen ovate, wholly yellow-red. The whole insect sprinkled with pale hair. Claws with a single inner tooth near the middle. (Five specimens.)

This is more like *E. rapax* Smith, than any other species known to me.

***Eciton Sumichrasti* Norton (nov. sp.).**

Worker minor. Length, 0.15–17 in. Black; antennæ, abdomen, and legs, reddish piceous. Head one-half wider than thorax, somewhat contracted behind, deeply emarginated, with sharp slightly recurved angles. Antennæ somewhat clavate. Mandibles short and stout; eyes minute. The whole head and thorax covered with large deep pits, rather confluent longitudinally upon the last. Sutures between parts of thorax distinct. Nodes of peduncle of equal size, the first coarsely punctured; no spines beneath; abdomen shining, polished. The whole body sprinkled with pale hair, most abundant on abdomen. All the tibial spines pectinate. Claws simple. (Seven specimens.)



***Eciton Mexicana* Roger.**

ROGER, Berliner entomologische Zeitschrift, 1863, sp. 97.

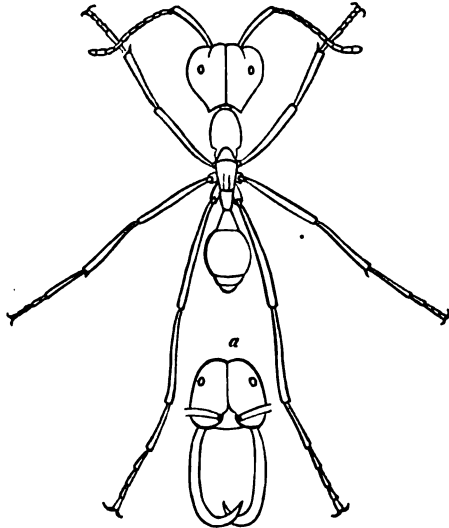
Worker major.

Length, 0.50 in.

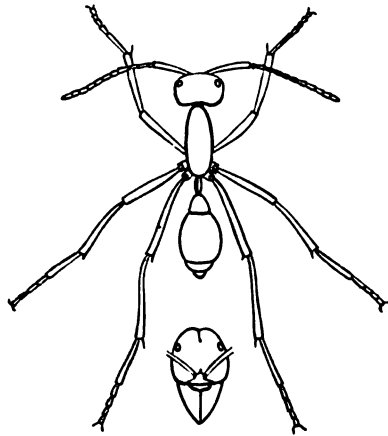
Worker intermedia. Length, 0.40 in.*Worker minor.*

Length, 0.25–0.35 in.

The worker major has long smooth sickle-shaped mandibles (fig. *a*). Mandibles of the other workers as usual; their surface smooth, biting edge without teeth. Eyes pearly white, small, angles at back of head, not acute; spinose projections on each side of metathorax distinct. First node of abdomen nearly as wide as long. Joints of flagellum rather long and slender. Head dull, not polished; color of head in major worker creamy white; of abdomen blackish, remainder of body ferruginous; color of second series ferruginous, abdomen black; of third series, black with the flagellum and tarsi ferruginous. This so closely resembles *E. hamata* Fab., that it is thought by many to be identical with it.



Worker major.



Worker minor.

***Pachycondyla Orizabana* Norton (nov. sp.).**

Worker. Length, 0.37. Color dull black, with the radicle and apex of antennæ, mandibles, and legs below tips of knees, ferruginous. Head subquadrate, long, emarginate behind; eyes small, round, placed below the middle of face. Antennæ inserted below the line of eyes, their basin small. Mandibles polished, with a few punctures near the teeth; teeth numerous. Head and thorax with somewhat confluent longitudinal striæ. Thorax compressed behind, the sides of mesothorax abrupt and margin angulate; separation of scutel and mesothorax obsolete. Node subquadrate, abrupt before, as high as next segment, not as wide; first segment as large as the second, margin of all the segments indistinctly ferruginous. Tergum dull, shining, without punctures or striæ. Spines of four hinder tibia simple, those of the anterior pair pectinate. Claws simple. (One specimen.) This may prove to be the worker of *P. Montezumia* Smith.

***Pseudomyrma thoracica* Norton (nov. sp.).**

Worker. Length, 0.25 in. Color, ochre-yellow, with the final segments of abdomen banded with fuscous, and the femora and tibiæ blackish in the middle. Eyes large; ocelli fuscous, mandibles tipped with black, strongly denticulate within, the first largest. Head once and a half times wider than thorax, slightly emarginate behind. Thorax flattened above; metathorax subquadrate, declivity abrupt, margins of sides almost angulate, a slight tubercle on each side near the front. A blunt tooth near the apex of first node beneath and near the base of the same. Abdomen with fuscous spots, on the hinder segments with blackish bands. The femora and tibia, except at base and apex, blackish. Claws bifid. (Ten specimens.)

***Pseudomyrma bicolor* Guérin.**

GUÉRIN, Icon. Rég. anim. III, 427. Brazil, Panama, Mexico.

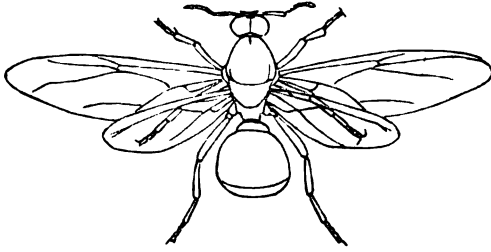


Worker. Length, 0.30 in. This is quite variable in color. The specimens examined are black, with the antennæ except lower half of scape, the prothorax, first node, and legs below the knees yellow-red.

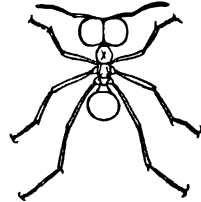
***Cleodoma Mexicana* Smith.**

SMITH, Brit. Mus. Cat. Hym. Vol. VI, p. 185.

Female. Length, about 1.00 in. Exp. wing, 2.00 in. Thorax one half wider than head, hairy, without spines; side angles of second node acute; color dark ferruginous; wings smoky yellow; costal margin blackish.



Worker major. Length, 0.50 in; *Worker minor*, 0.15 in. A spine on each lobe of back of head. Two spines on thorax before; two projections between and two spines on metathorax; a spine on pleura, above the anterior coxæ. Mandibles with about eight teeth; color, dark ferruginous; color of minor worker yellow-red.



Worker major.

***Cryptocerus multispinosus* Norton (nov. sp.).**

Worker major. Length, 0.27 in. Color black, the head and whole body dull with sparse coarse punctures, from each of which arises a short shining white hair. The produced sides of face, the anterior angles of thorax, tips of all the spines and anterior corners of abdomen testaceous. Margins of head and of cheeks each angular, partly covering the eyes, and extending forward above in a sort of scale as far as the margin of nasus, making the head nearly as wide before as behind; nasus and back of head emarginate; corners of head angulate, two spinose tubercles on the occiput, which has an abrupt declivity to hinder margin. Antennæ short, setaceous, base testaceous. Thorax twice as wide before as behind, emarginate in middle, with two spinose angles on each side, with a raised subangulate transverse connection; a



short blunt spine on each side of middle lobe ; metathorax contracted behind, with a strong angle at its upper corners, its concavity without setæ ; each node transverse, with a sharp spine, curving backward on each side, those on second node longest. Abdomen subcordate. Legs short, stout, black ; tips of femora, tibiæ, and final tarsal joint testaceous, or yellowish horn-color.

Worker minor. Length, 0.20 in. This has the tubercles on occiput subobsolete, and the declivity behind less abrupt ; the anterior angles of thorax nearly coincident, with no transverse connection.

II. *On the Phalangæ of the United States of America.*

By HORATIO C. WOOD, JR., M. D.

[Communicated December 8, 1867.]

INTRODUCTION.

THE PHALANGÆ, or Opilionina, as they are sometimes called, are a suborder of the Trachean Arachnids of the same rank as the Pedipalpi of the Pulmonary Arachnids.

The external skeleton, the *tegument*, contains chitine, as does indeed that of all the arachnids, remaining firm although becoming transparent, when the animal is soaked in a solution of caustic potash. It is variously ornamented with tubercles or spines, and more rarely punctated or excavated. Good specific characters can frequently be drawn from it.

The cephalothorax and abdomen are closely fused together, although in most cases the line of separation is more or less distinct. The cephalothorax is never, at least in any species the author has seen, at all segmented ; it is generally smaller than the abdomen, but in the family Gonyleptidæ, it is expanded into a broad plate, entirely overshadowing the very small abdomen. The latter is in all the Phalangæ more or less distinctly segmented.

Near the centre of the cephalothorax is a more or less prominent abrupt elevation or large tubercle, upon which the eyes are situated. This tubercle, or as I have called

it, *eye eminence*, in our species is mostly dark-colored, and more or less spinate or tuberculate. The eyes are two in number, rather large, simple. Near the anterior margin of the cephalothorax, on each side is an oblique stigmata. These have been mistaken for eyes, but are openings through the dermal skeleton.

The spiracles from which proceed the principal trachean trunks in the "Harvest-men" are placed between the posterior pair of coxæ and the abdomen.

All of the Arachnida have four pairs of feet, which in the Phalangidæ are chiefly remarkable for their length, and the number of their tarsal joints. The coxæ are large, conical, and converging towards the sternum. They are almost completely hid by the body of the animal. The next article, the trochanter, forms with the coxa a sort of ginglymoid joint. The trochanters are small, but often afford good specific characters. The femora are long and slender, and are distally connected with the shorter tibiæ, which in turn give attachment to the numerous series of short tarsal articles. In the Gonyleptidæ, the last pair of feet are the longest. In the Phalangidæ proper, the first and third pairs are about the same length and much shorter than the others; the fourth pair is not quite so long as the second.

The question here naturally presents itself, are the most anterior pair of feet true feet, *i. e.* sternal appendages, or in other words are the so called *octopodous* insects really eight-footed. The use of these organs as feet is of course no argument at all as to their homologies. Besides, in many Arachnids, such as the Phrynidæ and Thelyphonidæ, they are used almost exclusively as feelers, almost replacing the antennæ in function, and probably in very many other genera and families they answer the double purpose of limb and palpus. If a true spider be examined, the anterior pair of feet will be seen to be articulated to the sternum, and in all respects similar to the others. Nevertheless, I cannot think they are true sternal appendages, for the following reasons. If they be so, the thorax must consist of four segments instead of three, as in the true insects. In the Spiders, in Scorpions, Harvest-men, etc., the segments of the cephalo-

thorax are so fused together, that it is impossible to find any distinct sutures; but in the genus *Galeodes*, which in respect to the separateness of the head, thorax, and abdomen approaches somewhat the hexapods, the thorax is pretty distinctly divided into three segments. Again, although the attachment of the first pair of legs in many arachnids is apparently to the sternum, yet in others it is very distinctly not so. Thus in the *Thelyphonidæ*, it is placed on an entirely different plane from that of the truly sternal legs and the bases of the first pair of legs are indeed partially covered by the base of the maxillæ. In the *Phrynidæ* this is even more marked.

For these reasons, it would seem that the anterior legs of octopodous insects are really appendages of the cephalic segments.

In the mouth of a rapacious arachnid the most anterior organs are the so-called cheliceres, which project forwards or downwards from immediately under the labrum, or anterior edge of the cephalothorax. Latreille was, I believe, the first to regard these organs as modified antennæ. Siebold, who follows him in this, assigns as his reasons, the cerebral origin of their nerves, and the fact that they never act like the mandibles of the other *Arthropoda* in a horizontal direction.* The first of these reasons is not at all conclusive; for if the antennæ were absent, it would seem, *a priori*, most probable that the cerebral ganglion, not being called on to supply them with nerve power, would send a nerve to some of the mouth organs, and to which more naturally than to the most anterior? It is very doubtful whether such anatomical facts are of any aid whatever in tracing homologies; are the arms of man any the less appendages of the occipital vertebra, because they do not receive their nervous supplies from it? Again, the cheliceres of some arachnids do act in a horizontal direction, in the true *Scorpions* for example. The value of such a character is shown by the fact, that in one order, the *Pedipalpi*, the *Scorpions* have their cheliceres acting horizontally, whilst amongst the *Phrynids* they are vertical. Farther, the

* *Anatomy of the Invertebrates.* American edition by Burnett, p. 378.

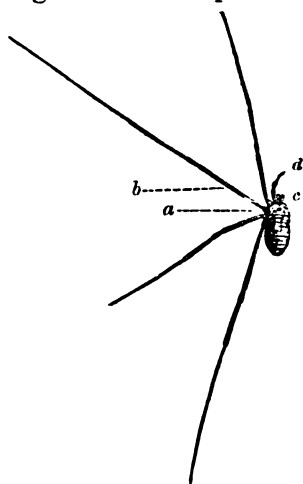
cheliceres occupy the same place and perform the same functions as the anterior maxillæ or mandibles of Coleoptera, so that the burden of proof certainly rests very strongly on those who assign them as the homologues of the antennæ. If, as stated by Professor Owen, some species of *Galeodes* have the rudiments of the antennæ attached to the cheliceres, it will strengthen the position that the latter are the homologues of the mandibles rather than weaken it. No such rudiments exist in the North American species, *Galeodes subulata* Say, which is the only one that I have seen specimens of; but in certain of the Harvest-men, there are two small processes placed superiorly and anteriorly to the mandibles, which must be regarded as the rudiments of the antennæ.

The mandibles or cheliceres in the Phalangidæ are two-jointed, the distal, larger article, being vertical and armed with a pair of forceps, one finger of which is fixed, the other movable.

The ligula is scarcely perceptible in the Phalangeæ.

The second prominent mouth-organs of the rapacious arachnids are those which form the large arm like weapons of the Scorpions. They are the homologues of the maxillæ and their palpi of the Coleoptera. Among the Harvest-men they have much more resemblance to the corresponding hexapod organs than is general. Their basal-joints, the representative of the maxillæ proper, are large, and so opposed as to act as jaws. The palpi are four-jointed, and strictly retain the form and use of palpi.

Such are the organs, which are most obviously parts of the mouth. Professor Owen suggests in his anatomy of the Invertebrates that the anterior pair of feet are modified labial palpi. This seems to be the most probable view



Phalangium ventricosum.
a, trochanter; b, femora; c, palpus;
d, mandibles.

of the subject. They appear to be cephalic appendages, for the reasons before given, and, if so, can hardly be other except labial palpi or antennæ. The presence of the rudiments of the latter on the cheliceres of certain Galeodes, and the total absence of any proof, are sufficient reasons for not considering them as misplaced antennæ. Again in certain arachnids, they not only perform solely the tactile function of both of these organs, but occupy very closely the position of the former. Thus in the Phrynidæ, they are placed just posteriorly and superiorly to the maxillæ. No distinct labium is acknowledged as existing among the arachnids, but if these organs are the labial palpi, in the Scorpions the two processes, which project forward from their bases, may be looked upon as a split labium. Such appears to me the most probable view of the homologies of these parts, but embryological studies can alone settle these completely. Among the Phalangææ the anterior pairs of legs are attached just in front and on the same plane as the others.

HABITS. The *Phalangidæ*, Harvest-men, "Daddy Long Legs," or "Grab for Gray Bears," as they are called in northern New York, appear to live equally well about the habitations of men and in the most lonely forests. I have seen hundreds of them running over the bushes and ground amongst the recesses of the Alleghanies, and every country lad has noticed them with wonder about out-buildings. I believe they are most active in the very early morning and evening, preferring twilight to the bright sun-glare. They are carnivorous, feeding on small insects, and are said to be especially addicted to aphids eating. The true spiders, and, indeed, nearly all of the rapacious arachnids, content themselves with sucking out the juices of their victims, but the Harvest-men appear to devour them, for which the opposing maxillæ seem to fit their mouths. I have seen one running with a half-devoured insect in its mouth; and Tulk, according to Siebold, has found fragments of insects in their alimentary canal.

The eyes of the Harvest-men, placed as they are on a prominence near the centre of cephalothorax, cannot enable them to see beneath them, or in fact to discern any near object much below their own level. The Phalan-

gium, however, when he walks, does not generally raise his body much above the ground, but so bends his long legs that their extremities are near the surface, whilst their central portion is high in the air. As a consequence of this the body of the animal is almost in the same plane as his prey, which he is thus enabled to watch during his approach. I have never seen a Harvest-man seize his victim, but, according to Herbert, "Sie springen und stürzen auf die Beute wie die Katze auf die Maus und halten sie mit den Palpen wie mit Händen selbst."*

Mr. A. Tulk,† speaking of the habits of *Phalangium Opilio*, says, "The harvest-spiders, at least the present species, are nocturnal in their habits and capture their prey, consisting of flies, mosquitoes, and small lepidoptera, by stealing cautiously towards it, and making a gliding spring upon the victim when within reach. I have repeatedly seen individuals of *P. cornutum*, when in confinement, pursue each other with the utmost pertinacity, the larger generally pouncing upon the former, and having brought them within reach of the chelicere and palpi by grappling them with their long legs, proceed to devour the body, leaving the extremities untouched. They use one of their legs occasionally to support the food to their mouth." In our northern climates, probably but few Phalangians survive the winter. Dr. Lincecum writes that large numbers winter in Texas, in the long moss (*Tillandsia usneoides*). In the spring, all of the specimens to be found in this neighborhood are evidently very young, just hatched. They are small, very soft and tender, and have not the coloration and other specific characters well pronounced. Towards the close of summer no more young specimens are to be met with. All of the females are then full of eggs. The eggs are said to be laid in the autumn in protected crevices, under dry stones, etc., hatching out in the spring.

CLASSIFICATION. In regard to the classification of this group, there is no doubt but that its value is that of a suborder, and that is naturally divided into two families,

*They spring and pounce upon their victim as the cat upon the mouse, and seize it with their palpi as if with hands.

†Annals and Mag. Nat. Hist. 1843, p. 246.

the *Phalangidæ* proper and the *Gonyleptidæ*, and that each of these groups is composed of several genera. A large number of so-called genera have been named by Koch in the work "Ueber sicht des Arachniden systems;" but have nowhere been described by that writer, at least in no place that I have been able to find. A careful study of the diagnoses of these genera as given by Meade,* has produced grave doubts as to their distinctness; and, certainly, it is impossible to rely upon the characters given as separating natural, or even artificial groups. *Phalangium cornutum* may be taken as the type of the Linnæan genus *Phalangium*, since the only species preceding it, in the 12th edition, is not well known. Most of our *Phalangidæ* are members of one large generic group, and for this the name *Phalangium* has been retained, since, in the absence of specimens of *P. cornutum*, I have not been able to find any characters distinguishing its members generically from that species, although it is very possible such characters exist.

There has come under my notice but a single North American species of the *Gonyleptidæ*, which appears to be a member of the genus *Gonyleptes* of Kirby.

The specific characters are drawn from the spines, tubercles, etc., on the surface of skin;—from the pattern of coloration; peculiarities of eye eminence; of legs, especially the trochanters; from the size; comparative lengths of the body and legs; and in the males, from the genital appendage. There appears to be something peculiar in the male organ of each species. For this reason, although not proposing here to discuss the internal anatomy of the *Phalangeæ*, it seems necessary to say a few words as to the genitalia. The rather long, slit-like genital openings in both sexes exist just posteriorly to the point of attachment of the last pair of legs. The penis, inclosed in a very pronounced sheath, extends along the median line for nearly the whole length of the abdomen. It is best exposed by slitting open the under surface of the abdomen at the sides and turning back the tegument like a flap. The sheath will then appear, and

* *Annals and Mag. Nat. Hist.*, 1855.

must be cut open before the organ itself will come into view. In the genus *Phalangium* the penis is made up of two portions, the body and a second piece, generally very small, and ending in a sharp point. The body of the male organ is traversed by the continuation of the spermatic duct or the ductus ejaculatorius, which opens at or near the distal end of the smaller article. In the latter part of summer many male Harvest-men may be found, in which the organ, with its sheath massed about its base, is extruded from the body.

Occupying a corresponding position with the last, in the female is a long, firm, almost cartilaginous, more or less annulated tube, the ovipositor, into the base of which opens the oviduct. This, like the penis, is capable of extrusion, and is provided with a sheath.

SUBORDER PHALANGÆ.

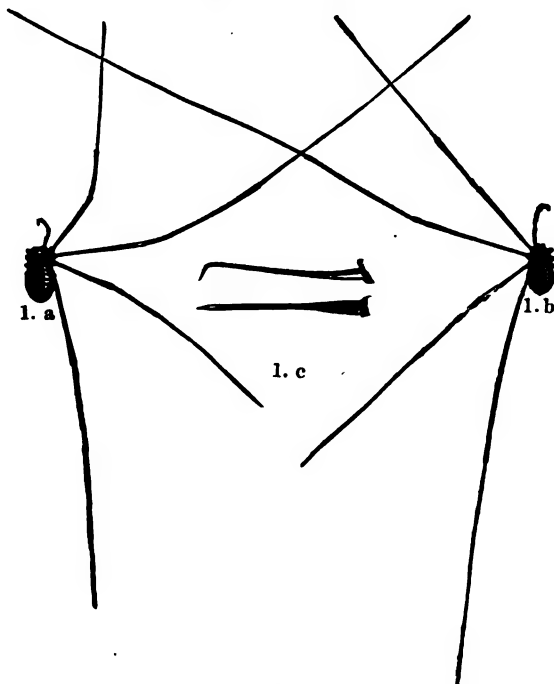
Respiration trachean. Thorax not distinctly articulated. Mandibles very conspicuous, free, terminated by a didactyle forceps. Abdomen annulate; no metamorphosis.

FAMILY PHALANGIDÆ.

Abdomen distinct superiorly. Coxæ of posterior pair of feet not more developed than the others, and radiating at about the same angle as the others. Tarsi multiarticulate.

Genus I. *PHALANGIUM* LINN.

Palpi without spines. Eyes two on a tubercle.

1. *Phalangium dorsatum* SAY.

1 a, female (natural size); 1 b, male (nat. size); 1 c, penis; anterior and lateral view.

P. DORSATUM Say. Journ. Phila. Acad. Nat. Sci., 1st se., Vol. 3, p. 66.

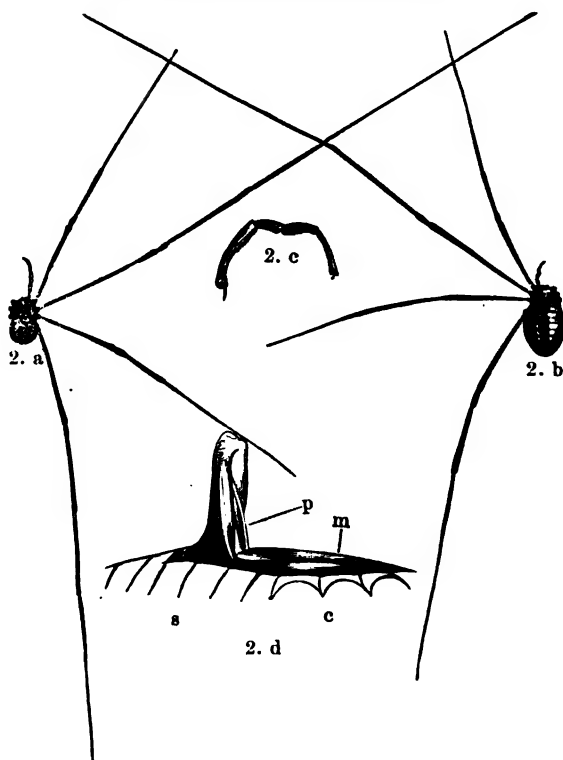
Dorsum minutely granulate; its general color grayish brown, with often a sort of a golden tint; anterior to the eye-spot, ornamented with a somewhat v-shaped or irregularly parallelogrammatic black marking on each side. At the eye eminence commences a dark blackish central marking, which is at first quickly expanded, then very much contracted, and afterwards gradually somewhat expanded, and then similarly again contracted, so as to form a strongly pronounced central vase-shaped marking extending from the eye-spot to the posterior extremity; besides, there is on the flanks a more or less distinct blackish band, and the surface of the abdomen is more or less spotted with black. Segmentation of the abdominal scutum well marked. *Eye eminence* prominent, scarcely at all crenulate. *Palpi* long, slender, grayish or reddish brown, more or less pubescent in the male with their under surface and lateral edges furnished with rows

of small black spinous tubercles. *Ventral surface* a grayish brown, tuberculate, with the abdominal segmentation strongly pronounced. *Coxæ* smooth or slightly tuberculate, grayish. *Trochanters* black. *Legs* brownish, darker in the male, with blackish rings at the articulations generally relieved by a whitish tipping. Spines on the feet small, not very numerous. *Penis* very slender, not very much flattened, distally bent nearly at right angles to itself, and ending in a long, thin, very acute point.

Length of Body, ♀, 0.3; ♂, 0.2. Length of Legs, ♀, (1) 1.4, (2) 3, (3) 1.4, (4) 1.9; ♂, (1) 1.4, (2) 2.4, (3) 1.4, (4) 1.9.

REMARKS. I have seen a number of specimens of this form collected in various localities near Philadelphia. It appears to be an outdoor species; most of the specimens in my possession were, if I am correctly informed, taken on black and raspberry bushes in gardens. The male and females are quite different. There are not only the usual differences of size and form, but the female is lighter in general color with little or none of the reddish hue so general in the male, the flank markings more distinct, the palpi grayish (rarely reddish), and the feet of a lighter brown; the crenations of the palpi are also less strongly pronounced and often not easily made out from their grayish tint. I have never seen these two forms actually *in coitu*, but am led to refer them to the same species by their general agreement of characters, and the facts that they have been found together, and the one are always male, the other female specimens. I have a single specimen from Elizabethtown in Northern New York, collected by my brother, George B. Wood, Jr. Also a large number caught near Washington, by Mr. Austin.

Mr. J. H. B. Bland, of Philadelphia, has given some small Harvest-men taken by him early in the spring, which appear to be the young of this species. In these the gray color of the adult is almost a milk-white; the eye eminence is also white.

2. *Phalangium vittatum* SAY.

2 a, male (natural size); 2 b, female (natural size); 2 c, palpus (magnified); 2 d, a portion of the under surface of the abdomen dissected off, and raised up so as to show the position of the penis (magnified); p, penis; m, muscles; c, first joints of legs; s, abdominal segments.

P. VITTATUM Say. Journ. Phila. Acad. Nat. Sci. 1st se. Vol. 2, p. 66.

MALE. — *Dorsum* varying from a rich yellowish brown to a strongly reddish brown, with a central dark vase-shaped marking, commencing at the eye eminence, as in the preceding species, but without any well pronounced black marginal markings; very hard, covered with closely placed, numerous, moderately small granules. *Cephalothorax* marked with dark brown. *Eye eminence* pronounced, brownish with a central dark band, furnished with a row of rather distant, but pretty well pronounced spinous tubercles over each eye. *Palpi* very long, light brown, with numerous spinous tubercles, similar to, but rather

more pronounced than in *P. dorsatum*, distally pubescent. Segmentation of the abdominal scutum pretty well marked, especially posteriorly. *Ventral surface* light brown, with the abdominal segments very distinct, without tubercles, save a few anteriorly. *Coxæ* of the same color as the belly, but covered with numerous close tubercles, tipped with white. *Trochanters*, light brown. *Legs* very slender, light brown, with black annuli at the distal femoral and tibial joints, which in some specimens involve the whole article, furnished with numerous small, black, spinous tubercles. *Penis* very slender, not flattened, distally bent at right angles to itself, into a moderately short, very sharp point.

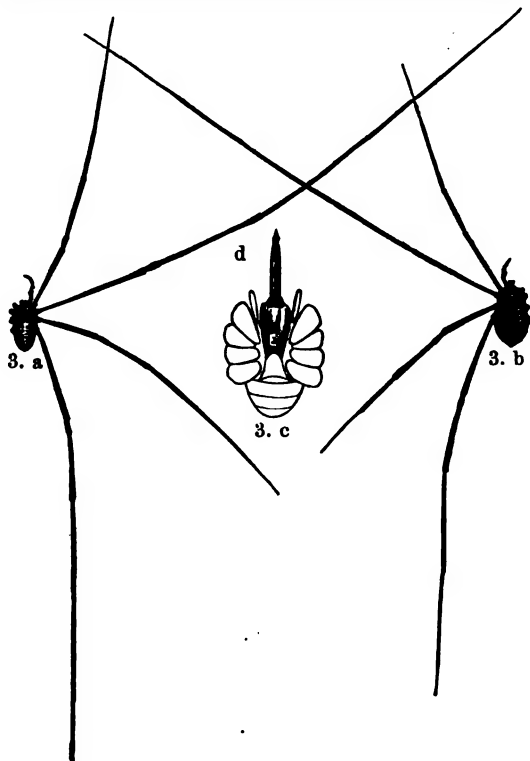
FEMALE.—With the general characters of the male, but much larger, and the palpi much shorter. The dorsal stripe not nearly so pronounced as in the male, and very often interrupted posteriorly. The legs not so dark.

Length of Body, ♀, 0.4; ♂, 0.25. Length of Legs, ♀, (1) 1.7, (2) 3.2, (3) 1.6, (4) 2.3; ♂, (1) 1.7, (2) 3.2, (3) 1.6, (4) 2.1.

REMARKS. This species is closely related to *P. dorsatum*, the principal characters separating the two are to be found in the differences in coloration of the dorsum and legs, the trochanter not being black in *P. vittatum*, and the much greater hardness and roughness of the upper surface of the southern species.

The color varies considerably. Some two or three specimens are nearly white.

This species was originally described by Mr. Say as an inhabitant of the Southern States, and may be looked upon as the southern representative of its nearest ally, *P. dorsatum*, of which I have never seen any specimens from farther south than Washington City. Most of the specimens of *P. vittatum*, which have come under my notice, were collected by Dr. G. Lincoecum in Texas, where it appears to be abundant. Like many other animals of the Neo-tropical fauna of North America, its range extends up into Nebraska, for I have a number of specimens collected last summer by Prof. F. V. Hayden, during his geological explorations of that State.

3. *Phalangium nigropalpi* Wood (nov. sp.).

3 a, male (natural size); 3 b, female (natural size); 3 c, under surface of body, showing the penis protruded (magnified), d, body of penis, e, its sheath.

Dorsum reddish brown; in the males of a nearly uniform tint, with some obscure grayish specks; in the females of a darker color, with a more or less obsolete central vase-shaped marking, and some grayish specks; with very minute tubercles, giving rather a velvety than rough appearance to the unaided eye. Segmentation of the abdominal scutum not marked. *Eye eminence* prominent, black, with a double row of rather small and distant spinous tubercles. *Palpi* rather long; in the male black, excepting the distal article, which is mostly brownish, with very few spinous tubercles, save a row on the inner side of the distal article, very pilose, with none of the angles prolonged; in the female brown, without the row of spinous tubercles on the distal article, but with the others perhaps more pronounced

than in the male, and with the distal angle of the second article prolonged into a more or less prominent blunt process. *Ventral surface* mostly of a similar, but little lighter color than the dorsum. *Coxæ* of the same color as the ventral surface, tipped with white. *Trochanters* blackish. *Legs* in the males black; in the female dark brown. *Penis* rather stout, flattened, at its distal extremity contracted and bent upwards, ending in a short acute point.

Length of body, ♂, 0.2; ♀, 0.3. Length of Legs, ♂, (1) 1.6, (2) 3.1, (3) 1.6, (4) 2.1; ♀, (1) 1.6, (2) 3.6, (3) 1.6, (4) 2.2.

REMARKS. I have a large number of specimens of this species captured by myself in the woods in Huntingdon Co., Pennsylvania. They were in great numbers running over the dried leaves, stones, bushes, &c. The males were much more numerous than the females, in fact I saw six times as many of them as of the latter. I was not so fortunate as to find any *in coitu*, but believe the two forms to be different sexes of the same species on the same grounds as mentioned in the remarks on a former species. The females are to be distinguished by their larger size, the brown color of their legs and palpi, as well as the darker and less uniform color of the dorsum, which also frequently loses almost all of the reddish tint.

4. *Phalangium exilipes* WOOD (nov. sp.).

Dorsum very closely, minutely granulate, of a dark blackish or a golden brown; with a pair of longitudinal, whitish, irregular bands commencing at the eye eminence and running anteriorly to the margin of the cephalothorax, where they are bent at right angles and prolonged into a narrow marginal band; each abdominal scutum with a more or less regular transverse series of very distinct whitish dots, which are often placed at equal distances from one another so as to form longitudinal as well as transverse series, but on other specimens the distance between those of the posterior scuta is only half that between those on the anterior scuta. *Cephalothorax* with a pair of grooves on each side anteriorly, somewhat parallel to the margin, behind the eyes with four very distinct transverse straight impressed lines and corresponding ridges. *Eye eminence* pronounced, remarkably smooth, slightly constricted at the

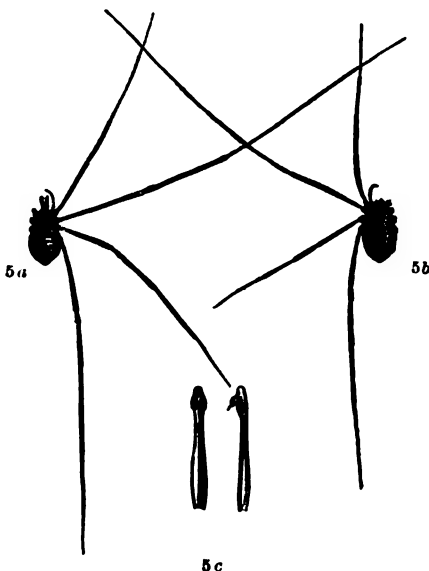


Penis, lateral and anterior views (magnified).

base, grooved above, with the somewhat conical eyes so placed as to give the appearance of two eye eminences joined together rather than of a single one. *Palpi* with none of their angles prolonged, rather short, proximally dark, distally light brown, with their proximal articles densely beset with very numerous spinules and with their maxillary portion furnished with two lobe-like processes. *Abdomen* very distinctly separated from the cephalothorax, distinctly segmented. *Venter proper* smoothish, light grayish brown. *Pectus* and *coxae* with very numerous small spines, of the same color as venter. *Trochanters* dark brown with their inferior angles prolonged into a small inconspicuous spinous process. *Legs* very slender, proximally light brown, distally somewhat darker, beset with numerous small blackish spinules. *Penis* robust; distally rapidly expanded into a broad portion whose very thin margins are bent upwards, so that with an equally thin central keel they form a pair of grooves on the upper surface; afterwards contracted into a robust but finally slender acute point placed at a slight angle to the main body of the organ.

Length of Body, ♂ ?, 0.25. Length of Legs, ♂ ?, (1) 1.8, (2) 2.7, (3) 1.8, (4) 2.1.

REMARKS. Of this species I have seen one specimen, taken by Dr. Leconte on the coast of California, Lat. 30°, 33'; also two collected by Mr. William M. Gabb, of the California State Geological Survey, in Nevada. The measurements given above are taken from Dr. Leconte's specimen, which was in such a condition that I could not determine the sex positively. The other individuals were males.

5. *Phalangium cinereum* WOOD (nov. sp.).

5a, male (natural size); 5b, female (natural size); 5c, penis, lateral and anterior views (magnified).

Body large. Dorsum with small, acute spinous tubercles on the abdomen arranged in transverse series generally one row to each segment; the base of these little tubercles are whitish, their acute apices blackish; color of dorsum grayish with a central darker vase-shaped marking commencing at the head; the flanks more or less mottled. *Cephalothorax* not distinctly separated from the abdomen. Segmentation of the abdominal scutum distinct. *Eye eminence* not very prominent, light-colored, with a row of tubercles similar to those on the dorsum surmounting each of the black eyes. *Palpi* light brown, moderately long, with numerous, short, rigid, black hairs, which are more pronounced in the male than in the female. *Legs* very long and slender, with numerous black spines arranged in rows, which are more pronounced in the male than female, light brown with darker annuli, which are, however, often obsolete especially in the male. *Coxæ* as well as ventral surface smooth, grayish brown, with darker irregular spots. *Trochanters* grayish, with small spines. *Penis* broad, rather thick, with distally two lateral oval openings, and immediately contracted into a short, blunt, obtuse process, which is bent at an

acute angle to the main process, and has projecting from it a very slender, acute point.

Length of body, ♀, 0.35; ♂, 0.3. Length of Legs, ♀, (1) 1.2, (2) 2, (3) 1.2, (4) 1.5; ♂, (1) 1.6, (2) 2.6, (3) 1.6, (4) 1.9.

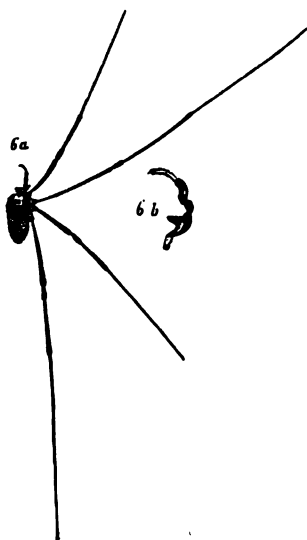
REMARKS. I have a large number of specimens of this species, collected by my brother, George B. Wood, jr., at Elizabethtown, in Northern New York; they were found in outhouses.

The males differ from the females in their more uniform and darker tint, and in the absence, or faintness, of the annuli on the limbs.

6. *Phalangium calcar* WOOD (nov. sp.).

MALE.—*Dorsum* dark reddish brown with minute spots of light brown, densely covered with small obtuse blunt black tubercles.

Cephalothorax with two impressed lines posteriorly. *Eye eminence* well pronounced, black, with two rows of acute robust spines. *Palpi* very robust and crooked, the second and third joints making an arch, the fourth joint another; these three, blackish, pilose and very much roughened by acute robust spines; the second joint armed near the middle of its inferior surface with a very large obtuse spur-like process; the distal article slender, light brown, very hairy, but without spines. *Abdomen* very distinctly separated from the cephalothorax by a curved impressed line, the segmentation not well marked anteriorly. *Ventral surface* reddish, with a few scattered granules on the pectus, none elsewhere. *Legs* very long and slender with rows of small spines. *Coxæ* reddish, the first two on each side with a row of spinous tubercles on their anterior margins. *Trochanters* reddish brown. *Penis* robust, flattened, very strongly curved, distally somewhat expanded and then abruptly contracted into a slender hook with a very acute point.



6a, male, upper view (nat. size); 6b, palpus, showing spur (magnified).

Abdomen very distinctly separated from the cephalothorax by a curved impressed line, the segmentation not well marked anteriorly. *Ventral surface* reddish, with a few scattered granules on the pectus, none elsewhere. *Legs* very long and slender with rows of small spines. *Coxæ* reddish, the first two on each side with a row of spinous tubercles on their anterior margins. *Trochanters* reddish brown. *Penis* robust, flattened, very strongly curved, distally somewhat expanded and then abruptly contracted into a slender hook with a very acute point.

Length of body, ♂, 0.25 inches. Length of legs, ♂, (1) 1.2, (2) 2.2, (3) 1.3, (4) 1.8.

REMARKS. I have seen but a single male of this species, which was received from Prof. E. D. Cope, who found it among the mountains of South-western Virginia. It is, I believe, an out door species living in the woods, and may possibly prove to be the southern representative of *P. nigropalpi*; bearing the same relation to it that *P. vittatum* Say does to *P. dorsatum* of the same author.

I have also received from the same source as the last two female Harvest-men, which I refer, with a good deal doubt, to the same species. They were taken in the same locality as the last, at a different time. They differ from the male especially in the absence of the spur-like processes on the palpi, as well as in the color of the trochanters. They may represent an undescribed species. The following is a description of them:

PHALANGIUM sp.?

Dorsum darkish or very dark brown, with lighter spots especially upon the sides, and with a more or less obscure central vase-shaped marking extending throughout its whole length, covered with small tubercles. *Cephalothorax* with two impressed lines posteriorly. *Eye eminence* very prominent, blackish, with two more or less irregular rows of spines. *Abdomen* distinctly separated from cephalothorax, its segmentation rather distinct. *Palpi* light brown, their basal joints roughened with numerous rather large robust spinules, aggregated, scattered or in rows. *Ventral surface* reddish brown, smooth. *Coxæ* reddish brown, distally tipped with whitish, their basal ends areolated, their anterior inferior borders each with a row of small tubercles, more or less obsolete on the posterior two pairs. *Trochanters* black, roughened with numerous small black spines. *Legs* light or dark brown, roughened with very numerous small black spines.

Length of body, 0.35. Length of Legs, (1) 1, (2) 1.8, (3) 1, (4) ?

7. *Phalangium bicolor* WOOD (nov. sp.).

FEMALE.—*Dorsum* blackish, of a nearly uniform tint, with an obscure lighter central line; furnished with a triangular patch of close, small, black tubercles on the cephalothorax, the base of the triangle being at the eye prominence; posterior to and separated from this by an intervening comparatively smooth space, is a transverse linear patch of similar tubercles, posterior to which is still another broad, large patch covering the central portion of the abdominal scutum, and posterior to this again are two or three transverse raised patches. *Cephalothorax* not at all distinct from the abdomen. Segmentation of the abdominal scutum not distinct. *Eye eminence* prominent with a double row of rather distant and well pronounced spinous tubercles. *Palpi* very light brown, somewhat pilose, with rather numerous scattered spinous tubercles on their basal articles. *Ventral surface* a whitish brown, granulate. *Coxæ* of the same color as the ventral surface, closely tuberculate, not tipped with black. *Trochanters* grayish. *Legs* very slender, brownish, with more or less pronounced blackish rings at the joints.

Female (natural size). The third leg was off the specimen.

Length of body, ♀, 0.2. Length of legs, ♀, (1)?, (2) 2.1, (3)?, (4) 1.5.

REMARKS. I have seen but two specimens, both females, for which I am indebted to Prof. Cope, who captured them near Haverford College, Delaware Co., Pa.

8. *Phalangium favosum* WOOD (nov. sp.).

FEMALE.—*Dorsum* almost a square level surface, with a sharp projecting angle at the sides; grayish brown with blackish spots, and the indications of a central vase-like marking; coarsely rudely punctate so as to have a worm-eaten, almost honey-combed appearance. *Cephalothorax* with two dark converging lines anterior to the eye eminence, and a short central one on its most anterior portion. *Eye*

eminence slender, rather high, light brown, with several robust acute spines, which are at their bases gray, but are tipped with black. *Palpi* rather slender, moderately long, without processes, but roughened by numerous small blackish spines. *Ventral surface* light gray, roughened by numerous small obtuse tubercles. *Coxæ* very large, gray, laterally dotted with black, very strongly roughened with large, obtuse tubercles. *Trochanters* blackish, often mottled with gray, with rather large spines, similar to those on the eye eminences. *Feet* proximally blackish, distally often grayish, sometimes tipped with blackish, roughened by numerous small acute spines.

Length of body, ♀, 0.3. Length of legs, ♀, (1) 1, (2) 1.7, (3) 1.1, (4) 1.3.

REMARKS. I have seen but a single specimen, a female, caught by Prof. F. V. Hayden, in Nebraska.

9. *Phalangium verrucosum* WOOD (nov. sp.).

MALE.—*Dorsum* hard, of a nearly uniform golden tint, with indications of a blackish central marking behind the eye spot, thickly covered with small tubercles. Eye eminence prominent, blackish on top, with a row of prominent, spinous tubercles surmounting each black eye. *Cephalothorax* with a slight impressed line immediately behind the eye eminence, and a second very strongly marked one posterior to this, very distinctly separated from abdomen by a curved impressed line. Segmentation of the abdominal scutum very marked posteriorly, not so much so anteriorly. *Palpi* slender, grayish, with none of their angles prolonged, beset on their upper surface with numerous small spines irregularly arranged in rows. *Ventral surface* light gray, with the coxæ closely studded with large prominent tubercles, giving under the glass a sort of warty appearance. *Trochanters* blackish, more or less covered with similar tubercles. *Legs* reddish brown, rather long and slender, armed with series of small blackish spines. *Penis* of the male very broad, rather short, nearly straight, thickened and somewhat dilated distally where it is alate, abruptly contracted into a rather robust end, which finally terminates in a very acute point, which is bent at an angle to the shaft, and furnished with two pairs of small lateral hooked spines at the base of the slender portion.

Length of body, ♂, 0.2. Length of legs, ♂, (1) ? (2) 1, 5, (3) 1.7, (4) 1.3.

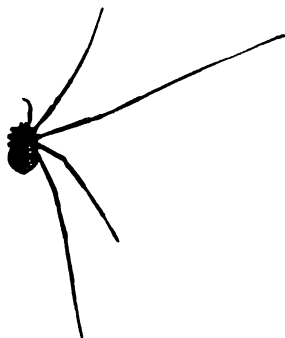
REMARKS. I have seen only some males, in the collection of Essex Institute. Locality unknown.



Penis, and line to show the angle at which the point is set on the body (magnified).

10. *Phalangium formosum* WOOD (nov. sp.).

FEMALE. — *Dorsum* perfectly smooth, grayish, more or less obscurely margined with dark brown, and ornamented with a broad vase-shaped central, dark marking, which commences on the anterior portion of the cephalothorax, and terminates abruptly near the junction of the middle and posterior third of the abdomen; the whole of the dorsum which is anterior to the posterior third of the abdomen has more or less of this peculiar brownish tint. *Eye eminence* moderately prominent, smooth. *Palpi* slender, without spines, distally minutely pubescent. Segmentation of the abdominal scutum not pronounced, except posteriorly. *Ventral surface* grayish brown not tuberculate.



Female (natural size).

Coxae of the same color. *Trochanters* black. *Legs* light brown, annulate with dark brown, provided with very minute spinous tubercles, especially on their femora.

Length of body, ♀, 0.3. Length of legs, ♀, (1) 0.6, (2) 1.3, (3) 0.6, (4) ?.

REMARKS. I have seen four specimens of this handsome species from the District of Columbia, collected by Mr. Austin, and have received a number from Mr. J. H. Bland, collected in the vicinity of Philadelphia. The latter, with the exception of a single female, are very immature; the former are all females. All the individuals which have come under my notice are remarkable for their softness and fragility.

11. *Phalangium pictum* WOOD (nov. sp.).

FEMALE. — *Dorsum* light gray, with a strongly pronounced central dark marking, which is broadest anteriorly, involving almost the whole of the cephalothorax, at the posterior edge of which it is rapidly contracted, then sharply expanded and again contracted into a nearly square space on the abdomen, finally running as a stripe to the anus; the surface smooth generally, furnished before the eye eminence with a curved series of acute, black, very small spines on elevated bases, and a similar short transverse row; behind the eye

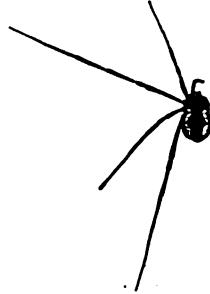
eminence, with a rather pronounced transverse series, and several more or less obsolete ones on the abdominal surface, also with a few similar scattered spines. *Eye eminence* light brown, with a couple of more or less irregular series of spines similar to those on the body. *Palpi* hispid, mottled, with their femoral joint somewhat enlarged at its inner distal angle, and the next two articles short and swollen. *Cephalothorax* not at all distinctly separated from the abdomen. *Segmentation* of the abdominal scutum not at all marked. *Ventral surface* a light grayish brown, hispid. *Coxæ* covered with spinous hairs. *Trochanters* light brown. *Legs* short, moderately robust, roughened with rows of small sharp black spines.

Length of body, ♀, 0.2. Length of legs, ♀, (1) 0.6, (2) 1.1, (3) 0.7, (4) 1.

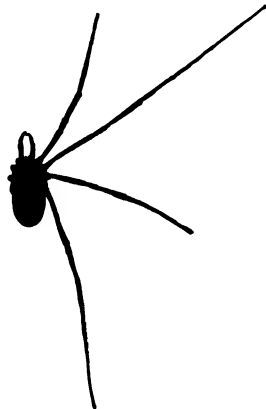
REMARKS. I have seen but a single specimen, a female, in the collection of the Essex Institute, which was taken near Salem, Massachusetts.

12. *Phalangium maculosum* WOOD (nov. sp.).

Body large. *Dorsum* dark ferruginous brown, with an often obscure central vase-shaped darker marking, and numerous very small light spots arranged on the abdomen, more or less irregularly, in transverse series, closely granulate; in some specimens the dorsum is grayish, with a well pronounced vase-shaped marking and dark transverse bands in which are the light spots. *Cephalothorax* not very distinctly separated from the abdomen. *Segmentation* of the abdominal scutum not very distinct anteriorly, posteriorly more so. *Eye eminence* black, with a double crest of small more or less obsolete crenulations. *Palpi* brownish, mottled and tinged with black; with the inner angles of their second and third joints slightly prolonged; with not very numerous very small black spiny tubercles, more pronounced at the joints; distally pilose. *Ventral surface* light brown, obscurely tuberculate. *Coxæ* light brown, tuberculate, frequently with a little black spine on their distal



Female (natural size).



Female (natural size).

end. *Trochanters* black. *Legs* dark brown. *Penis* robust, somewhat flattened, distally alate, bent through its entire length with a double bow-like curve; at its distal extremity blunt, not bent, with a sharp, slender, straight, projecting point.

Length of body, ♀, 4. Length of legs, ♀, (1) 1, (2) 1.6, (3) 1, (4) 1.8.

REMARKS. In this species there are no marked differences between the males and females. I have found them in the woods in different parts of Pennsylvania. I also have specimens collected in Western Virginia, by Prof. E. D. Cope.

13. *Phalangium ventricosum* WOOD (nov. sp.).

FEMALE.—*Body* large. *Dorsum* reddish brown, with a blackish, vase-shaped central marking, sometimes strongly pronounced, sometimes obsolete, and minute lightish spots, which, on the abdomen are more or less irregularly arranged in transverse series; closely granulate. *Cephalothorax* about as distinctly separated from abdomen as in previous species. *Eye eminence* moderately pronounced, black with a double crest of rather small black acute tubercles. *Palpi* light brown, rather long and slender, furnished with minute spiny tubercles, which are more pronounced at the joints and on their proximal portion, pilose, not branched, their angles not prolonged. Segmentation of the abdominal scutum not very marked, more so posteriorly than in *P. maculosum*. *Ventral surface* smooth, light brown with abdominal segments often bordered posteriorly with a lighter, and anteriorly with a darker tint. *Coxæ* light

7. Supposed male (natural size).

brown tipped with white, tubercular, furnished at each lateral inferior margin with a row of minute spiny tubercles. *Trochanters* light brown, spiny. *Legs* long and slender, light brown, furnished with rows

7a. Penis, front and lateral views (magnified).

Length.—Pennsylvania specimen, ♀, body, 0.4; legs, (1) 1.8, (2) 2.5, (3) 1.8, (4) 2.

Nebraska specimen, ♀, body, 0.4. Legs, (1) 1.2, (2) 2.1, (3) 1.2, (4) 1.7.

REMARKS. I have seen a single female of this species, taken near this city, from which the above description has been drawn up. In the collection made by Dr. Hayden, in Nebraska, were a number of female Harvest-men, which present apparently the same specific characters as the former, except that the legs are a little shorter. Suites of specimens from the two localities would, however, probably show them to be distinct. The processes, which I believe to be the rudiments of the antennæ, are in the Nebraska specimens remarkably large. I have never received any males in the same collection as the females, but append a description of a male Phalangium, which may be referable to this species. Prof. E. D. Cope collected two specimens in Western Virginia, and a third has been received from the Essex Institute, from an unknown locality.

P. VENTRICOSUM?

MALE. — *Dorsum* ferruginous brown, covered with numerous tubercles, with a very obscure central marking. *Eye eminence* moderately pronounced, blackish, smooth, with a faint, median, brown line, without crenulations or with very obscure ones. *Cephalothorax*, with a very deep, transverse line behind the eye eminence. *Abdomen* very distinctly separated from the cephalothorax by a strongly pronounced, curved, impressed line, remarkably conical. *Ventral surface* light brown, covered with small tubercles. *Coxæ* of the same color, distally tipped with white, much roughened on the inferior surface with small spinous tubercles, with a row of the same on the lateral borders. *Trochanters* brownish. *Legs* very slender, of the same color as the dorsum but darker, with very small blackish spines. *Palpi* slender, moderately long, roughened with small spinous tubercles, their angles not prolonged. *Penis* flat, nearly straight, slender at the basal portion, gradually widening, and distally rather quickly expanded into a broad alate portion, and then abruptly contracted into a moderately robust slightly curved point, which is placed at an angle to the rest of the shaft; at the base of the point a marked notch in the end of the shaft.

Length of body, 0.25. Length of legs, (1) 1.3, (2) 2.2, (3) 1.2, (4) 1.7.

14. *Phalangium grande* SAY.

"Body oval, covered with short spines; ocular tubercle spinous; feet rather short.

"Body oblong oval, scabrous, with approximated, robust, short acute spinules; rufo-ferruginous, two impressed transverse lines before the middle; ocular tubercle prominent, slightly contracted at base, crowned with numerous, robust, acute spinules; clypeus hardly elevated; feet rather short; pectus with numerous, minute acute granules; venter with but few.

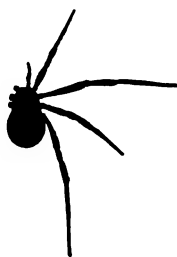
"Length of female, nearly seven-twentieths of an inch. Inhabits the Southern States."

REMARKS. I have never seen any specimens of this species. The description given is the original one of Say. See "The Complete Writings of Thomas Say, on the Entomology of North America, ed. by Dr. J. L. Leconte." New York, 1859, vol. ii, p. 14.

15. *Phalangium nigrum* SAY.

P. NIGRUM Say. Journ. Acad. Nat. Sciences, 1st Series, vol. 2, p. 66.

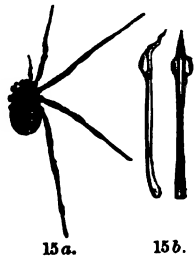
Dorsum very firm and hard, its general tint brown, with lighter spots, covered with small black tubercles. Segmentation of the abdominal



15, Female (natural size).

scutum not very well marked. Eye eminence moderately prominent, covered with tubercles like those on the dorsum, brownish. Palpi moderate, distally pubescent, not very spiny, their distal joints in the male with rows of small spinous tubercles on their inner surface, which

tubercles are obsolete in the female in whom the prox-



15 a, Variety. Male (natural size); 15 b, Penis, anterior and lateral views (magnified).

imal joints are more spiny than in the male. Ventral surface reddish brown. Coxæ, with the proximal portion of the femora, of the same color; distal end of the femora with the next two articles, blackish brown. Legs granulate, without spines, save very

small ones on their distal portion, especially at the metatarsal joints. *Penis* slender, proximally subcylindrical, then flattened, and slightly expanded, then rapidly expanded into a broad, somewhat circular, very thin, alate portion, then suddenly contracted and bent at an obtuse angle, ending in a very fine point.

Length of body, ♂, 0.25; ♀, 0.3. Length of legs, ♂, (1) 0.5, (2) 0.8, (3) 0.5, (4) 0.7; ♀, (1) 0.6, (2) 0.9, (3) 0.6, (4) 0.8.

The ground color of the dorsum of this species is a rather light brown, but the numerous black tubercles give it a much darker appearance; where these are wanting, the light brown appears as little dots or spots. The sexes do not differ materially, except in point of size.

REMARKS. I have received a large number of specimens of this Harvest-man, collected by Dr. Lincecum, in South Texas, also two or three specimens taken in Nebraska, by Prof. F. V. Hayden. With the Texan specimens were three phalangia of very different appearance, which, however, appear not to be specifically distinct. The size is much less than in the others, and the dorsum and proximal portions of the palpi and legs are of a deep uniform black; otherwise, the characters are as in the preceding.

The form just described has been recognized as *P. nigrum* Say, but as there are some slight disagreements with the description of that authority, and the localities are widely separated, it is possible that it is a distinct species. For this reason the essential portion of the original description of Say is appended.

"*Body* ovate, a little dilated each side behind the posterior feet, blackish, with a few obsolete paler spots, above and beneath granulated, granules spherical, irregularly placed in somewhat reticulated lines; ocular tubercle destitute of spines, with obtuse granules; *clypeus* prominent, somewhat elevated; *feet* short, fuscous, whitish at the base; *second pair* hardly four times as long as the body, and, with the first pair, armed with a prominent, cylindric, obtuse spine behind the basal joint; *third pair* with a similar spine before; *pectus* whitish; *venter* blackish.

"Length, female nearly one-fifth of an inch. Not uncommon in the Carolinas and Georgia."

Genus II. ACANTHOCHIEIR LUCAS.

PHALANGODES Tellkamp. Archive für Naturgeschichte. 1844, p. 320. *Non Gervais.*

Palpi spiny. Eyes none.

Under the name of *Phalangodes armata* Dr. T. Tellkamp has described a Phalangium from the Mammoth Cave, Kentucky, which is evidently generically distinct from our ordinary species. Unfortunately the generic name had been previously applied by Gervais to a genus of the Gonyleptidæ, and hence Lucas* has substituted the name which is here adopted.

16. *Acanthochieir armata* Lucas.

“Diese spinne unterscheidet sich von den mir bekannten Phalangern durch die armirten Fühlerfüsse (palpi) und durch den Mangel der Augen.

Brust und Hinterleib sind nicht getrennt, letzterer deutlich geringelt.

Oberkiefer (mandibula) scheerenförmig, vorn behaart, Unterkiefer nicht stark hervorragend. Fühlerfüsse 5 gliedrig mit langen zum Theil gegliederten, dornförmigen Fäden bewaffnet. Das letzte Glied in eine scharfe Spitze auslaufend. Augen fehlen.

Beine 4 mal so lang als der Körper; am vorderen Fusspaare ein einfaches Häkchen, an den beiden letzten Fusspaaren (die 2^{ten} fehlten an unserm Exemplare) drei Häkchen, durch eine Membran verbunden, welche bei der Stellung einen hohlen Beutel bildet; die hinterste Klaue ist aber beweglich, wie ich bei einigen Füßen sah, wo dieselbe nach vorn, zwischen den beiden seitlichen Häkchen eingeschlagen war, wodurch dann die dazwischen liegende Membran eine Fläche bildete.

Bei dieser Anordnung kann die Membran, nach Analogie der Saugwarzen wirken, wenn nämlich die drei Häkchen in einer Ebene aufgelegt und dann das hintere erhoben wird; liegt der Rand der Membran fest, so entsteht dadurch ein luftleerer Raum.

Körper kurz eiförmig, unten ziemlich stark behaart. Farbe weiss. Länge des Körpers $\frac{1}{4}$ ''' . Länge der Beine 2''' .

Die Länge der Beine differirt wenig, die vordersten sind zwar etwas kürzer als die beiden hintersten Paare, aber die Differenz ist doch nur 195 : 205. Obwohl die Kleinheit des Thieres die Vermuthung erwecken

* Ann. Soc. Entomol., vol. viii, 1860, p. 977.

könnte, dass die Augen übersehen sind, so bin ich doch von deren Mangel überzeugt, da die helle Farbe des Thieres eine sehr gute Beleuchtung von oben gestattete, so dass eine Vergrösserung von 100 mal im Durchmesser mit grosser Deutlichkeit angewandt werden konnte."— *Tellkampf*.

FAMILY GONYLEPTIDÆ.

Cephalothorax very much enlarged, and more or less completely overshadowing the abdomen. Coxæ of the posterior pair of feet directed backwards, very much enlarged. Tarsi not multiarticulate.

Genus I. GONYLEPTES KIRBY.

GONYLEPTES Kirby. Trans. Linn. Soc., vol. xli, p. 452.

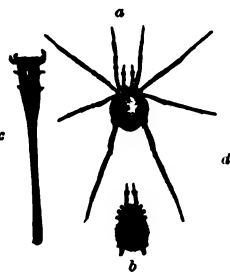
"Mandibles chelate. Palpi unguiculate. Tarsi 6-10 articulate."

The characters of this genus here given are those of Mr. Kirby.

17. *Gonyleptes ornatum* SAY.

G. ORNATUM Say. Journ. Acad. Nat. Sciences, 1st Series, vol. 2, p. 68.

Dorsum smooth, of a dark ferruginous color, darker in the central portions and at the position of the eyes, and often with a pair of nearly black spots on the posterior third of the cephalothoracic portion. *Cephalothoracic scutum* bordered with small spines, which are more or less obsolete anteriorly, also furnished with an irregular transverse series near its posterior edge, and with two central, widely separated, pairs of obtuse spines or tubercles in its middle and posterior thirds respectively. *Abdominal segments* bordered with equidistant, tuberculous spines. *Eye eminence* scarcely perceptible, without spines. *Eyes* widely separated, black. *Palpi* of the same color as the body, or a little lighter, without spines, but with the margins of their third and fifth joints with obtuse crenulations, besides scattered ones on other joints; third and fifth joints widely dilated. *Legs* dark brown, roughened with more or less pronounced, small, obtuse spines; their metatarsal joints



16, Male; a, under surface (natural size); b, upper surface (natural size); c, penis (magnified.)

roughly pubescent. *Ventral surface* smooth. *Penis* straight, cylindrical, distally much enlarged and abruptly truncated, its end furnished on each side with three curved, hook-like spines.

Length of body, .02. Length of legs, (1) 0.45 (2) 0.55, (3) 0.45, (4) 0.7.

REMARKS. The specimens which I have agree in most respects well with Mr. Say's description, but are all of a uniform ferruginous color. Of the two pairs of spines on the dorsum, the posterior are the larger. They were collected by Dr. Lincecum, in Texas. It is possible that a comparison with Florida specimens might show them to be distinct. As Mr. Say's description may not be accessible to some entomologists, and the identification is somewhat doubtful, I append the original description of *G. ornatum*.

"*Ocular tubercle* hardly elevated, unarmed; hind feet remote; two erect spines behind. *Body* ovate, reddish ferruginous, destitute of granules; edge slightly contracted over the insertion of the fourth and fifth pairs of feet; two small acute tubercles on the middle of the disk, and two large, prominent, erect, acute spines on the hind margin; no impressed line before the middle; an anterior arcuated yellow transverse line connected to a posterior undulated one by a yellow line, which is crossed near the middle by two obsolete yellow bands. *Ocular tubercle* slightly raised, unarmed; distance between the eyes much greater than their diameters, orbits black. *Clypeus* abruptly somewhat acute in the middle of the tip. *Mandibles* rather small, the fingers subequal, and crossing each other at the tip. *Palpi* robust, and when at rest concealing the mandibles. *Penultimate* articulation dilated on the exterior side, and elongated and depressed. *Terminal joint* half as long as the preceding, cylindrical. *Terminal nail* elongated, movable, capable of being inflected. *Feet* short, not three times as long as the body, three anterior pairs before the middle, posterior ones behind the middle, and remote from the others; fourth and fifth pairs with double nails. *Abdomen*, segments with a series of equidistant, minute tubercles.

"Length one-fifth of an inch.

"This remarkably distinct species, we first discovered on Cumberland Island, Georgia, and subsequently many specimens occurred in East Florida, where it appears to be common. It is not an inhabitant of the Northern States."

SYNOPSIS OF THE KNOWN NORTH AMERICAN
PHALANGÆ.

Family PHALANGIDÆ.

GENUS I. PHALANGIUM Linn.

Cephalothorax with two eyes.

* Second pair of legs over 2.25 inches long.

1. *P. DORSATUM* Say. Dorsum somewhat tuberculate, reddish brown or grayish with a strongly pronounced blackish central marking. Palpi reddish brown, with edges strongly crenulate. Trochanters black. Length of body, ♀, 0.8; ♂, 0.2. Length of second pair of legs, ♀, 8; ♂, 2.4.

2. *P. VITTATUM* Say. Dorsum as in last, more tuberculate, harder. Palpi very long, reddish brown, edges strongly crenulate. Trochanters reddish brown. Length of body, ♀, 0.4; ♂, 0.25. Length of second pair of legs, ♀, 3.2; ♂, 3.2.

3. *P. NIGROPALPI* Wood. Dorsum reddish brown, in male uniform; in female with an illy pronounced central marking. Palpi, in male, blackish; in female brownish, not strongly crenulate. Length of body, ♀, 0.3; ♂, 0.2. Length of second pair of legs, ♀, 3.1; ♂, 3.1.

4. *P. EXILIPES* Wood, ♂. Dorsum reddish brown, uniform, or with light spots, minutely tuberculate. Palpi light grayish brown, with very small blackish tubercles. Trochanters dark reddish brown. Length of body, 0.25. Length of second pair of legs, 2.7.

5. *P. CINEREUM* Wood. Dorsum with spinous tubercles, grayish, with a central dark vase-shaped marking. Palpi light brown, with numerous short rigid black hairs. Trochanters grayish. Length of body, ♀, 0.35; ♂, 0.3. Length of second pair of legs, ♀, 2.00; ♂, 2.6.

** Second pair of legs not more than 2.25 inches long.

6. *P. CALCAR* Wood, ♂. Second joint of palpi with a long robust spur-like process. Dorsum reddish brown. Length of body, 0.25. Length of second pair of legs, 2.20.

7. *P. BICOLOR* Wood, ♀. Dorsum blackish, uniform. Ventral surface whitish. Palpi with scattered tubercles. Length of body, 0.2. Length of second pair of legs, 2.1.

13. *P. VENTRICOSUM* Wood, ♀. Dorsum reddish brown, with an obscure central marking. Trochanters light brown. Length of body, 0.4. Length of second pair of legs, 2.2.

40 WOOD, PHALANGÆ OF THE UNITED STATES.

14. *P. GRANDE* Say. Body covered with spines.†

*** Second pair of legs less than 1.75 inches in length.

8. *P. FAVOSUM* Wood, ♀. Dorsum grayish, deeply punctated or pitted, flat. Length of body, 0.3. Length of second pair of legs, 1.7.

9. *P. VERRUCOSUM* Wood, ♂. Dorsum golden or reddish, densely tuberculate, with an obscure central marking. Trochanters blackish. Length of body, 0.2. Length of second pair of legs, 1.7.

10. *P. FORMOSUM* Wood, ♀. Dorsum smooth, with a dark central marking involving more or less the whole anterior surface, terminating abruptly near the junction of the middle and posterior third of the abdomen. Trochanters black. Length of body, 0.3. Length of second pair of legs, 1.3.

11. *P. PICTUM* Wood. Dorsum smooth, with some spinous tubercles, grayish with a strongly pronounced dark marking, extending to the end of the abdomen. Trochanters light brown. Length of body, 0.2. Length of second pair of legs, 1.1.

12. *P. MACULOSUM* Wood. Dorsum dark brown, with an obscure darker marking. Trochanters black. Palpi sharply tuberculate. Length of body, ♀, 0.4. Length of second pair of legs, 1.6.

15. *P. NIGRUM* Say. Dorsum black. Var.; dorsum dark brown, with minute grayish brown spots. Trochanters black. Palpi sharply tuberculate. Length of body, ♀, 0.3. Length of second pair of legs, 0.9.

GENUS II. *ACANTHOCEIR* Lucas.

Cephalothorax without eyes.

16. *A. ARMATA* Lucas.

Family *GONYLEPTIDÆ*.

GENUS III. *GONYLEPTES* Kirby.

17. *G. ORNATUM* Say.

† I am uncertain whether this species belongs in this or some other of these artificial groups.

ERRATA. — In explanation of figure on page 13, read c, mandibles (not palpus), and d palpus (not mandibles).

III. *On Insects Inhabiting Salt Water.*

BY A. S. PACKARD, JR.

[Communicated Dec. 7, 1867.]

THE occurrence of insects living in brine or salt water has been noticed by several authors in this country.

In 1852, Mr. T. R. Peale writes to Capt. H. Stansbury (Report on the Valley of the Great Salt Lake of Utah, p. 379) that in a mass of exuviae of insects brought from the shores of the Great Salt Lake there was an abundance of the larvæ and exuviae of the pupæ of Chironomus and fragments of other Tipulidæ.

In the same year, Dr. J. L. LeConte described two species of Staphylinids, *Thinopinus pictus* Lec. (Annals of the Lyceum of Natural History of New York, vol. v., p. 215), from the shore of the Pacific at San Diego, California; and *T. variegatus* Lec. (List. Col. N. Amer., p. 23; Smithsonian Misc. Coll.), from San Francisco, Cal., and Alaska? Dr. LeConte states in the "American Naturalist" (vol. ii, p. 329), that they are "found below high water mark on the wet sand. From the variegation of pale yellow and black they are singularly Crustacean-like, both in the larval form and in the perfect state."

In the Proceedings of the Boston Society of Natural History for Dec. 26, 1866 (vol. xi, p. 8, 1867), Prof. A. E. Verrill states "that the Museum of Yale College had received some dipterous larvæ from Mono Lake in California, a body of water not only excessively salt, but also strongly alkaline; together with them had been found a species of *Artemia*, a genus of *Entomostraca* allied to *Branchipus*, which had hitherto been known only in the salt-pans of Europe. The dipterous larvæ [Ephydra] were found in immense numbers, but the fly had not been reared. He had also received eggs, apparently of the same group of insects, from Salt Lake in Texas; the stick upon which they were laid was covered with salt crystals."

In Europe, numerous species of Coleoptera have long been known to inhabit saline places and the shores of the

ocean, but Dr. Loew, in 1864,* has been the first to notice at any length insects of other suborders found in brine. He has found the following species of Diptera living in the brine of the salt works of Dürrenberg, Saxony:—*Ephydra riparia* Fallen (*Halmopota salinaria* Loew), *Lispe crassiuscula* Loew, *Thinophilus flavipalpis* Zetterstedt, *Medeterus tenuicauda*, Loew and *Atissa* sp.

Chironomus oceanicus, n. sp.

While dredging on the first of August in Salem harbor, our attention was called to numerous larvæ, which had apparently attained their full size, and were creeping briskly over the surface of the floating leaves of the eel-grass, *Zostera marina*; while others were concealed in a

* I am indebted to the kindness of Dr. H. A. Hagen for the following additional bibliography of this subject.

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- GERMAR (E. F.). Der salzige See der Grafschaft Mansfeld. Thon's Archiv, 1829 T. 2. Heft. 1, p. 11-12. Maden im Kochsalze. (Piophilus aceti.) Stettin. Ent. Zeit., 1841, T. 2, p. 126.
- HARRIS (T. W.). Upon the natural history of the Salt-marsh Caterpillar (Arctia pseuderminea). Mass. Agricultural Repository, 1823. Vol. i, No. 4, June, p. 322-331. New England Farmer, 1823. Vol. i, No. 49, July 5, p. 385-386. Description of a remedy against the Caterpillar which destroys grass in Salt-meadows. New England Farmer, 1823. Vol. i, p. 238.
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- SCHILLING (P. S.). Ueber den Salzbohrkäfer (Ptinus salinus.) Arbeiten d. Schlesischen Gesellsch. f. vaterlaend. Cultur. Breslau, 1843, p. 179. (separate p. 9.)
- TAUSCHER (A. M.). Der Salzsee Inderskoe und seine Umgebung in der Kirgisischen Steppe Asiens. Neues Lausitzisches Magazin, 1823. T. 1, p. 27-51. (p. 48 Salzinsecten.)
- WAHNSCHAFTE (M.). Ueber einige salzhaltige Lokalitäten und das Vorkommen von Salzkäfern. Berlin Ent. Zeit., 1861. T. S. p. 185-187.

rude case or tube, almost wholly submerged, formed of the debris collected upon the surface of the leaves. The larva was exceedingly active, moving briskly about; or, if in its case, rapidly drawing its body in and out, and snapping with its long curved mandibles at the vegetable refuse within reach. It also fed upon the fine sea-weeds, such as the green filamentous species, and a species of *Ceramium*; and occasionally eat into the side of a *Terebella*-like worm, also found living on the surface of the leaves. Its food, then, mainly seems to consist of sea-weeds, the red kinds coloring the intestine and fæces brown, but it also probably consists in part of animal matter.

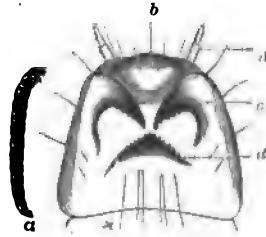


Fig. 1.

The body (Fig. 1, *a*, enlarged about three times) is cylindrical, slightly diminishing in size towards the end. The head is slightly flattened, and quite free from the thorax. The pair of prothoracic legs are very extensible, but retracted almost within the body when the head is bent upon the breast. The three thoracic rings are a little larger than the adjoining abdominal ones, and the sutures of all the segments are but faintly marked. The pair of anal legs are long and well developed, and terminate in a single crown of hooks (Fig. 2; *a*, portion of the dorsal vessel), which can be entirely retracted out of sight. In the forelegs the hooks are much more numerous (Fig. 3, *a*), and arranged in longitudinal rows, about twenty-five in number, those on the upper side of the tip being much the largest; those at the base being minute. The tracheæ were distinct, the two main branches extending along the whole body, from the last abdominal to the prothoracic segment.

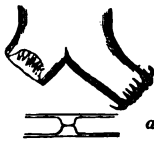


Fig. 2.

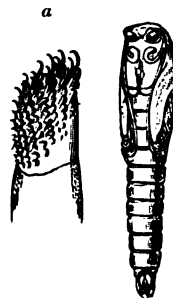


Fig. 3.

It is pale whitish in color, the thoracic rings being tinged on the harder parts with green. It is .22 to .25 of an inch in length.

On the 24th of September some young larvæ, one-fourth the size of the adult, were found, at which date, however, most of the larvæ were pupating, the semipupæ being found in the thin cases. On the same date several pupæ were found in which the fly was nearly ready to appear. A male imago appeared Oct. 9, and a female Oct. 14, 1867. During the last of April of the present year (1868) we found the same larva in abundance among the green filamentous weeds at low-water mark, so that there are undoubtedly two broods in a year; the first brood of flies appearing in the early summer, the second brood appearing late in the autumn, and the species undoubtedly passes the winter in the larva state.

The head seen from above is nearly square, being a little longer than broad, with a pair of simple eyes of unequal size situated a third of the distance from the anterior to the posterior end of the head, and with a few bristles on the head. The two-jointed antennæ (Fig. 1, *a*) are well developed, the basal joint being quite stout. The labrum (Fig. 1, *b*) is transversely ovate; the mandibles (Fig. 1, *c*) are long, much incurved, and serrate on the inner edge; the maxillæ are obscurely developed, forming a fleshy, two-jointed tubercle. The labium (Fig. 1, *d*) is somewhat triangular and multidentate on the anterior edge (indicates the œsophagus.) This larva differs from a fresh-water larva of this genus from Lake Champlain, in not having the three 3-jointed filamentous appendages inserted just above the anal legs. (See also Westwood's figure 124, in his *Classification of Insects*, vol. ii.)

After the larva has become mature and ceases eating, it retires within its rude case, and there awaits its transformations. The first signs of the presence of the growing pupa are the enlargement of the thoracic segments, especially the mesothoracic, and at the same time the compound eyes of the fly can be seen just behind the two simple eyes of the larva, and the legs of the fly can be seen through the transparent larva-skin. They are very long and doubled up on the sides of the body. The prothoracic legs are quite separate from the two posterior

pair, which latter are seen beneath the mesothorax of the larva. At this time, also, can be seen the secondary tracheal branches, a pair for each abdominal segment. At a later stage, just prior to the moulting of the larval skin, the head and all the limbs and the wings are free from the body. After the skin is moulted the head of the pupa (Fig. 3, ♂, front view) is bent down upon the breast, and the limbs and wings folded closely to the body. The short antennæ are curved beneath the eyes, while the long slender legs are folded and curved up beneath the extremities of the wings. The body of the pupa is straightened out, the long slender abdomen being but very slightly curved. The head is sunken in the full, much rounded thorax. The wings are rather narrow, and the abdomen rather slender. There are no thoracic filaments, nor is the abdomen terminated with hairs, but the genital armor is well developed, as shown in our figure. In these respects the pupa seems to differ from what we suppose to be the typical forms of *Chironomus*.

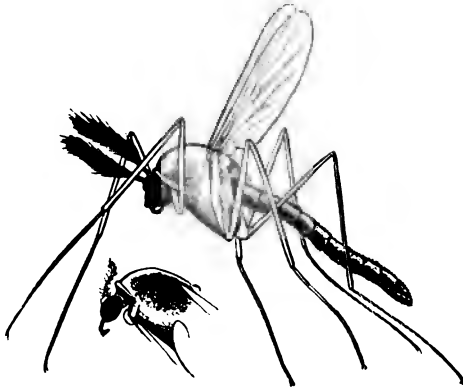


Fig. 4.

Imago. ♂. (Fig. 4, with head of ♀.) The antennæ of the male are about as long as the thorax, arising from a large knob-like basal joint; the joints are of even length, and from each one arise long, delicate hairs, which in our specimens were somewhat appressed to the antennæ, as shown in the figure, but we think it was owing to the immaturity and dampness of the specimen, and that the hairs stand out as usual in the genus. The lingua is short; palpi well developed, incurved; eyes large, globose, prominent, black. The body is throughout pale testaceous; on the anterior half of the thorax

is an oblong light-brown spot, and an irregular lanceolate oval spot on each side of the posterior half of the abdomen extending to a point opposite the insertion of the wing. On the under side of the mesothorax is a broad, flattened corneous area, the forelegs being widely separated from the two posterior pairs. The sides of the thorax are pale with a few dusky spots. The legs are long and very slender, the middle and hind tibiæ and tarsi dusky. The wings are white, reaching when folded to the end of the third segment from the end of the body. The abdomen is dusky-brown, paler at the tip, with a dusky spot on each side of the two last segments; on the under side is a faint greenish tinge. The tip is flattened, the anal forceps are large with the tip bent in, forming a V; and meeting on the median line of the body.

Compared with what is apparently a true *Chironomus* from Labrador, and other species living in Massachusetts, the thorax of the present species is longer, and less globular, the mesosternum presents a longer area, and the antennæ are longer and slenderer. The wings are unspotted; there is no transverse costal veinlet at the base of the wing; the costal vein terminates beyond the middle of the wing, and the first subcostal veinlet terminates on the outer third of the wing, differing in these characters from the more typical *Chironomi*. The abdominal hairs are also shorter.

The female (Fig. 4, head), has short, seven-jointed antennæ, of which the terminal joint is nearly twice as long as the one next to it; they are slightly hairy. The female of our species differs from the other true *Chironomi* in the shorter and stouter antennæ and shorter and smaller palpi. The eyes are much as usual, as is the size of the head in proportion to the thorax. Our ♀ specimen was too incomplete for further description.

***Ephydra halophila*, n. sp.**

The next saline insect we describe comes from the Equality Salt Works, of Gallatin county, Illinois. Specimens were forwarded to the Institute by Mr. E. T. Cox, with the following notes on their occurrence: —

"I send you the larva and pupa of a dipterous insect [Ephydra], found in the salt brine at the salt works near Equality, Gallatin Co., Ill., in such prodigious quantities as to fill up the wooden conduit pipes. These larvæ [puparia] are gregarious, collecting in masses, and form great rope-like bunches by clinging around small fibrous roots on the sides of the little ditch that conveys the brine from the first "Graduation or Thorn house," to the pump at the furnace. The brine as it comes from the well has a strength equal to 7 3-10 Baume, and is graduated after the German plan, by showering it successively over thorn bushes arranged on beams from top to bottom of three separate frames, from forty to forty-five feet high, called "Graduation or Thorn houses." What is remarkable in this is, that the above larvæ can nowhere be found except in the brine after first graduation, that is, passed over the first house, when they are found in such quantities as to prove a great nuisance. Neither in the fresh water, weak brine, or brine of second and third graduation can they be found at all. The people at the works believe that they are generated by some peculiar property in the water acquired after first graduation. I send them in their favorite brine."

The pupa of another species of fly (*Eristalis*?) was found in the same place. "The fly [identified by Baron Osten-Sacken as a species of *Ephydra*] of the first worm sent you was seen in great abundance on the pool at the bottom of the Graduation house. When alarmed they will fly up a few inches from the water, then alight upon it again in another place, and will glide about upon its surface with rapidity and the greatest ease. I think the worms come from a small egg, deposited by the fly, which sinks to the bottom of the water, where it is hatched, and the first visible stage of life is a very small white maggot, that crawls, or rather wriggles about on the bottom until the pupa is matured; they then attach themselves by a thread-like appendage to sticks and roots and to one another, forming great knots or ropes. In this way they remain fixed until the fly is fledged. I send you some of the small white maggots. You have already some of the matured larvæ, and empty cases."

The specimens of the larvæ sent by Mr. Cox in the brine were too much decayed for identification, so that at present we can only describe the puparium and imago. The body of the puparium (Fig. 5, *b*) is rather long, cylindrical, but flattened towards the thorax and head, with the tip so recurved that the anal, or last pair of abdominal feet, curve inwards touching the abdomen under the sixth pair of feet. From the tergum of the last segment is thrown off a long breathing tube, terminating in two widely diverging, slender, filiform branches. The head is not more corneous than the remaining part of the body, and is continuous with the thorax, being transversely flattened, oblong, and half as long as broad. The mouth-parts and eyes are obsolete. The thorax is much

flattened above, the posterior portion of the third thoracic ring being cylindrical and continuous with the abdomen, the flattened portion beginning near the posterior margin of the segment, and being regularly rounded, the edge of this flattened portion extending diagonally forwards on the sides. The under surface of the thorax is convex and rounded continuously with the abdomen; the 1-4 abdominal rings are equal in size and length; the fifth is much smaller, with very large feet; the sixth segment is half as thick as the fifth, and the legs are reduced to mere hooklets, like those on the basal segments of the abdomen.

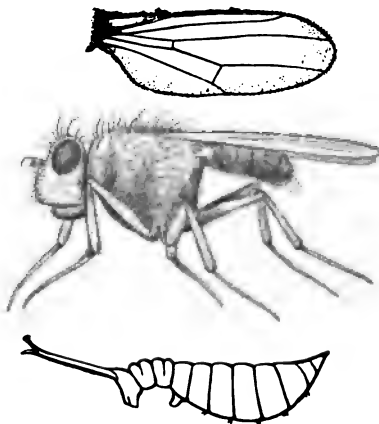


Fig. 5.

The respiratory tube arises from the base of the seventh segment; it is directed a little backwards, while posteriorly the seventh segment curves around to the insertion of the large anal feet which are crowned with a circle of hooks. There is one pair of thoracic tubercles armed with black hooks. The middle pair of abdominal feet, or tubercles, are placed a little farther

apart than the others. On the back of the second thoracic segment is a pair of narrow black stripes, extending faintly to the middle of the next segment, and on the 2-5 abdominal segments is a pair of irregular squarish black spots, united into one on the fifth segment. The color is a pale horn; there are very minute hairs giving the skin a finely shagreened appearance. Length of body .38; of the respiratory tube .12; total, .50 of an inch. The pupa can be seen, with the head of the future fly beneath the last thoracic segment of the puparium, while the tip of the body of the pupa rests beneath the fifth abdominal segment.

The imago (Fig. 5; *a*, wing) is coppery green, legs testaceous; femora with a greenish tinge above; tarsi fuscous. On the vertex is a broad, shining bluish-green area, very free from hairs; a similar bluish-green spot just in front of the antennæ. Front very full, rounded convex, pale green, with a pale, almost yellowish tinge, concolorous with the under side of the head, except beneath the eyes and behind the mouth, where it is darker green; a few long hairs on the vertex. Thorax and abdomen green, with scattered black hairs. The antennæ blackish-green, three-jointed, the third being minute and sunken in the head; the second joint large and spherical. Length .15 of an inch.

As this subject is so interesting, and as I have been unable to obtain any of the larvæ, I condense Loew's description of that of *E. riparia* (*H. salinaria*) in order that they may be recognized, and their habits farther studied in this country.

The larva is white, nearly six lines long, nearly cylindrical, pointed anteriorly, and acutely pointed behind, with two long extensible respiratory filaments on the terminal segment of the body. Beneath, are seven pairs of short, somewhat wrinkled fleshy tubercles, beset with black bristles. The three anterior segments of the body are formed into a cone, the anterior very small, with the mouth-opening a little turned up, with a pair of small curved mandibles partly concealed, with one-jointed rudimentary palpi, and two-jointed antennæ. On the second body-segment (prothoracic?) are the anterior stigmata which project out like a short, cylindrical spigot. The body is covered with very minute hairs. It lives in the bottom of the pools of brine, and creeps out of the water to transform, when the body shortens, the two last segments becoming united into a conical tube, while the respiratory tubes themselves remain unchanged, but become directed almost perpendicularly, and the under side of the abdomen is more arched. The larvæ were infested by a Chalcid, perhaps identical with *Pteromalus salinus*, which seems to destroy many of the larvæ.

I have also collected the puparium of an *Ephydra* at

Square Island, Labrador, where it probably occurred in a fresh-water or brackish-water lake, for the specimen slipped into my collecting bottle without attracting notice, though had it been found on the sea-shore, it would at once have gained special attention. It differs very slightly from the Illinois puparium, chiefly in the larger abdominal legs, *i. e.* the hooked fleshy tubercles.

During the past year Mr. J. H. Emerton has detected, at Marblehead, Mass., the puparia of another species of this genus in a salt water pool containing ulvæ, etc. They are a little larger, but otherwise closely allied to the Illinois species. I have also received from Dr. T. d'Oremieulx of New York, a puparium, scarcely distinguishable from the Illinois specimens, which he found under the sea-weed on the shores of Narragansett Bay.

The species from Mono Lake differs much from the others in having much larger tubercles, the two last pairs being large and prominent. The body is longer and larger, and the segments more convex than in any of the species mentioned above.



Fig. 6.

A puparium of a fly allied to *Eristalis* (Fig. 6) was also received from Mr. Cox, who states that it is found in the brine of the Equality Salt Works associated with *Ephydra*.

We can record another salt water *Eristalis*, a puparium having been found Sept. 5, 1865, by Mr. C. A. Putnam in the salt water canal (of the Naumkeag Factory) leading into Salem harbor. The specimen is in the collection of the Essex Institute.

It is evidently a *Helophilus*, agreeing closely with Westwood's figure 131 (8) in his "Modern Classification of Insects," vol. ii. The body of our specimen is cylindrical, a little flattened beneath, and the cephalic end is somewhat truncated, the tergum sloping rapidly to the head. Just behind the head is a pair of horny slender tubercles, about three times as long as thick, the more anterior pair of tubercles seen in the figure of *Eristalis*? (fig. 6) are obsolete in the present specimen. The body is covered with dense fine hairs, and on the under side are

minute transverse tubercles, and a pair of larger ambulatory tubercles are situated on each ring. The respiratory tube is simple, not divided; the filiform simple terminal portion being about $\frac{1}{4}$ as long as the whole tube. Length of the whole body .90; of the tube .48 inch.

NOTE.—The excellent drawings illustrating this paper were made by Mr. J. H. Emerton. My description of the mouth-parts of *Chironomus* (Fig. 1.) were taken from his drawings, made from the larva when alive. The drawings of *Chironomus* and details were all made from living specimens.

IV. *Synopsis of the Polyps and Corals of the North Pacific Exploring Expedition, under Commodore C. Ringgold and Capt. John Rodgers, U. S. N., from 1853 to 1856. Collected by Dr. Wm. Stimpson, Naturalist to the Expedition.*

BY A. E. VERRILL.

PART IV. ACTINARIA. With three Plates.

[Continued from Vol. V, p. 330.]

SUBFAMILY, SAGARTINÆ Verrill.

Family, *Sagartiadæ* Gosse, 1858; Actin. Brit., p. 9, 1860.

Column perforated by small openings (cinclidæ) from which long slender filaments (acontia) are emitted, more or less abundantly, when unusually irritated. These acontia are chiefly composed of nettling organs, and appear to serve as organs of defence. They are withdrawn after the disturbance has ceased. Surface of column either smooth or with minute contractile suckers. Tentacles numerous, usually slender and pointed, diminishing in length towards the margin; very contractile, like the disk and column.

METRIDIUM Oken.

Metridium Oken, Lehrbuch der Naturg., III, p. 349, 1815 (non Ehrenberg, 1834, Dana, 1846, Gosse, 1860.)

Actinoloba (pars) Blainv., Dict. des Sci. nat., 1830; Gosse, *Actinologia Brit.*, p. 11, 1860.

Cribrina (pars) Ehr., Corall., rothen Meeres, p. 40, 1834.

Metridium Edw. and Haime, Coralliaires, I, p. 252, 1857; Verrill, Mem. Boston Soc. Nat. Hist., I, p. 21, 1864; Trans. Connecticut Academy, I, p. 478, Feb., 1869.

Form very changeable, sometimes as broad as high, at other times very much elongated, pillar-like, the disk broader than the column and undulated or frilled at the margin. Basal disk broad, well developed, highly muscular. In contraction the form is usually that of a low cone or hemisphere. Surface of column smooth, with a distinct thickened fold near the top, above which the integument is thinner than below. *Cinclidæ* scattered over the sides, not very numerous, inconspicuous, without raised borders. *Acontia* abundant, but not often emitted except when much irritated. Tentacles small, very numerous, scattered on the disk, the inner ones at a considerable distance from the margin and much the largest; the outer ones very small and crowded at the margin, where they form a dense fringe.

METRIDIUM FIMBRIATUM Verrill, these Proceedings, Vol. IV, p. 151, 1865; Trans. Connecticut Acad., Vol. I, p. 478, 1869.

Harbor of San Francisco, Cal., adhering to the lower surface of floating timber, October, 1855. Dr. William Stimpson. Puget Sound. Dr. C. B. Kennerly.

METRIDIUM sp.

A species which has a well-marked submarginal fold, but with the marginal tentacles larger than usual in the genus.

Port Jackson. Dr. Wm. Stimpson.

CEREUS Oken.

Cereus Oken, Lehrbuch der Naturg., Vol. III, p. 349, 1815. (*Type, C. bellis.*)

Actinocereus Blainv., Dict. Sci. Nat., Vol. LX, p. 194, 1830.

- Oridrina (pars)* Ehr., Corall. rothen Meeres, p. 40, 1834.
Cereus (pars) Edw. and Haime, Coralliaires, Vol. I, p. 263, 1857.
Sagartia (pars) Gosse, Actinologia Britannica, p. 25 and 123, 1860.
Cereus Verrill, Bulletin Mus. Comp. Zool., p. 58, 1864; Revision
 Polyyps E. Coast U. S., p. 24, 1864; Review of the Corals and Polyyps
 of W. Coast, in Trans. Connecticut Academy, Vol. I, p. 480, 1869.

Column very changeable in form, highly contractile, its surface uninterrupted by a fold below the margin; its upper portion provided with contractile suckers. Cinclidae, or lateral pores scattered, well developed, but inconspicuous, emitting many long, thread-like acontia. Disk broad, often undulate at the edge. Tentacles very numerous, conical, the inner ones largest, scattered on the disk, outer ones small and crowded.

The reasons for restricting this name to the group having *C. bellis* for its type have been given by me in the works quoted above.

CEREUS STIMPSONII Verrill, sp. nov.

Disk broad, the margin not undulate. The inner tentacles much the largest, conical, rather short, pointed, forming two rows of fourteen each; the rows near together but the tentacles distant in each. The inner row placed a little more than half way from the mouth to the margin. Outer tentacles crowded in many indistinct rows, much smaller, short and pointed. Mouth narrow, elongated, with many lateral folds upon the large lips. Acontia long, thrown out profusely in an alcoholic specimen. Color of disk varied with alternating radiating streaks of darker and lighter lead-color, brownish yellow, and white; column colored in a similar manner. Tentacles lead-color, the larger ones tipped with vermilion. Diameter of disk, in expansion, 1.25 inches; longest tentacles .25 of an inch in length.

False Bay, Cape of Good Hope, on rocks in twenty fathoms. Dr. Wm. Stimpson.

The same or a similar species occurs abundantly on rocks in the littoral zone.

This species appears to be closely allied to *C. bellis*

Oken. In alcohol it contracts into a low cone, the surface strongly corrugated and roughened with small elevated portions, the openings (*cinclidæ*) at the summit of small verrucæ, not very numerous, scattered over the surface.

CEREUS SINENSIS Verrill, sp. nov.

Plate 2, figure 3.

Base expanded, adherent to shells. Column in full expansion much elongated, smallest in the middle. Disk not much exceeding the column. Mouth surrounded by numerous small folds. Tentacles about one hundred and twenty; the inner row of twelve little more than half way from the mouth to the margin, considerably larger than the rest. Outside of these the tentacles become successively smaller and more crowded to the margin, forming three or four rows. All the tentacles are rather long and slender, the outer ones not becoming so short as in many other species.

Color of column pale grayish, with twelve longitudinal stripes of purple. Mouth and disk fawn-color; the latter radiated with streaks of purplish, yellowish, etc. Tentacles yellow, annulated with six rings of purple, the basal band being purple. Among the submarginal tentacles are six conspicuous white ones.

Off the China coast, near Hong Kong, in ten to thirty fathoms, on a large *Voluta*, May, 1854. Dr. William Stimpson.

The affinities of this species are with *C. parasitica* of Europe, and *C. sol* of the Carolina coast.

In alcohol, some of the specimens are contracted into a broad, nearly flat disk, the edges very thin, others form hemispheres and rounded cones. The surface is smoother than in the preceding species. *Cinclidæ* inconspicuous.

CEREUS sp.

A species resembling the preceding in form and structure, but unaccompanied by notes upon the color, etc.

Ousima, Japan. Dr. Wm. Stimpson.

SAGARTIA Gosse (restricted).

Sagartia (pars) Gosse, Trans. Linn. Soc., XXI, p. 267, 1855; Actin. Brit., p. 25 and 122, 1860.

Paractis (pars) Edw. and Haime, Corallaires, I, p. 248, 1857.

Sagartia Verrill, Review of the Polyps of the West Coast of America, in Trans. Connecticut Academy, I, p. 482, March, 1869.

This genus, as here intended, includes those species considered as most typical by Gosse.

These have fewer and more elongated tentacles than the preceding genera, and the tentacles are also more concentrated towards the margin, leaving a broader naked area around the mouth. The wall of the body is nearly smooth, with inconspicuous suckers, which are, perhaps, wholly wanting in some species. The acontia are present in different quantities in the various species.

Some of the following species here included may not really belong to the genus, since the presence of acontia has not been demonstrated, but they are in such cases placed here on account of their resemblance to known species in structure and habits.

SAGARTIA RADIATA Verrill, these Proceedings, Vol. V, p. 50, 1866.

Actinia radiata Stimpson, Proc. Philadelphia Acad. Natural Sciences, 1855, p. 375.

Vol. V, plate 1, figures 5, 5a, 5b.

Base expanded, oblong, always attached to small, elongated spiral shells. Column in expansion forming a low cone; the disk much smaller than the base; in contraction much depressed, radiated with white. Tentacles slender, tapering, pointed, arranged in two close alternating rows at the margin, about forty in number.

Longest diameter of base .5 of an inch.

Color of body light brown, with radiating stripes of chalk-white, which gradually widen towards the base. Mouth radiated. Disk spotted with flake-white around

the mouth. Tentacles pale brown, with spots of dark brown and flake-white, in pairs.

In alcohol contracted to a low cone. Mouth everted. Tentacles not concealed, rather stout, conical. Column strongly corrugated and uneven with raised portions. Cinclidæ not observed.

Kagosima Bay, Japan, twenty fathoms, shelly bottom.

Found in considerable numbers attached to a small *Pleurotoma*, Jan., 1855. Dr. Wm. Stimpson.

SAGARTIA NIGROPUNCTATA Verrill.

Actinia nigropunctata Stimpson, l. c., p. 375, 1855.

Plate 2, figures 2, 2a, 2b, 2c.

Base expanded, broader than the column, which is moderately elevated, subcylindrical, smooth, with five longitudinal lines towards the base. Disk small, with the long pointed tentacles arranged closely around the margin. Mouth small, oblong, with small folds on the sides, and a spot at one end. Two of the tentacles, corresponding with the long diameter of the mouth, are longer than the others, and one of them has a flake-white spot on each side of the base. Diameter .75 of an inch.

Color of body pale orange-yellow; two rows of distant, small, black, alternating spots, ten in each row, surround the column. Tentacles dark at the inner side of base, forming a dark grayish ring around the disk.

Ousima, Japan, in crevices among rocks adhering to stones, in the lower part of the littoral zone, generally partly buried in gravel, January, 1855. Dr. William Stimpson.

In alcohol contracted to a low cone. Surface nearly smooth. Tentacles only partially contracted, short, conical, pointed, much crowded. No cinclidæ were observed, but acontia protruded from the ruptured base of one specimen.

According to Dr. Stimpson "this species appears to have little or no variation in its characters. It adheres

to the fingers by its tentacles, which can be very much elongated at times."

SAGARTIA (?) PAGURI Verrill, sp. nov.

Carcinophilus Paguri Stimpson, MS.

Base always attached to a smooth round space upon the outer side of the large claw of a species of *Pagurus*. Column low. Tentacles short and blunt; ten of them larger, forming an inner row; outside of these are about fifty smaller ones, crowded at the margin.

Color pale orange, in contraction cream-colored above, brown below. Tentacles pale, annulated with two or three gray rings; inside blackish.

In alcohol contracted to nearly a flat disk, surface smoothish. Tentacles wholly withdrawn. Openings, which appear to be cinclidæ, are sparingly scattered over the surface, arranged in imperfect lines.

China Sea, N. lat. 23°, in twenty to thirty fathoms, sand, April, 1855. Always parasitic on *Diogenes Edwardsii* St. Dr. William Stimpson.

SAGARTIA LINEATA Verrill, sp. nov.

Column elongated, at about the middle of the body forming a kind of sheath into which the upper part and the tentacles can be withdrawn. Tentacles in three confluent rows, the outer ones somewhat smallest.

Color of column dark green, the longitudinal sulcations, opposite internal lamellæ, still darker green, sides longitudinally striped with twelve crimson lines at regular intervals. Upper portion of body, above the fold, clear dark green. Tentacles bright yellow.

Hong Kong harbor; common on stones and pebbles among gravel, in the lower part of littoral zone, March, 1855. Dr. William Stimpson.

The color seems to be remarkably constant, being the same in all the specimens examined, except one, which had pale grass-green tentacles, and two pairs of whitish lines between the pink lines of the sides.

SAGARTIA sp.

An extremely simple species. Color pale brown, inclining to olive around the margin of the disk.

Port Lloyd, Bonin Islands, under stones in the lower part of the littoral zone, October, 1854. Dr. William Stimpson.

SAGARTIA (?) NAPENSIS Verrill.

Actinia napensis Stimpson, l. c., p. 376, 1855.

Plate 2, figures 4, 4a.

Base wider than column, which is smooth, elongated and subcylindrical in full expansion; in contraction forming an elevated cone, broadly rounded at top. Disk broad, about equal to diameter of column. Tentacles not very numerous and rather large, pointed, arranged in two rows near the margin. Mouth protruded, with the lips strongly lobed; margin of disk crenulated. Height of column 1.5 inches. Color of column fawn-colored below, greenish above. Disk around mouth mottled with yellowish and spotted with white. Mouth within streaked with yellowish. Tentacles dark green with rhomboidal white spots on the inner surface.

Napa-Kiang, Loo Choo Islands, attached to pebbles beneath the sand, and expanding its tentacles at the surface, in the second region of the littoral zone. Common, November, 1854. Dr. Wm. Stimpson.

• **CANCRI SOCIA** Stimpson, l. c., p. 376, 1855.

Base dilated, secreting a firm, thin, horn-like or chitinous membrane, which covers the carapax of Dorippe, and is held in place by the posterior legs of the crab. Column elevated in expansion, contracting into a very thin disk. Tentacles numerous, long and slender, crowded near the margin. Cinclidæ not observed.

This genus is closely allied to *Adamsia* and *Cereus*. From the latter it differs in the presence of a basal secretion and the more marginal position of the nearly equal

tentacles. From the former it differs in its elevated column, regular form and large size of the disk, elongated tentacles, and the absence of conspicuous cinclidæ near the base.

It is the only genus of *Actinidæ*, except *Adamsia* (*A. palliata*), in which a solid secretion is formed by the basal disk. In *Cancrisocia* it has a concentrically striate structure, the striæ being evidently lines of growth. The mode of formation seems to be this. The crab when very young selects a very small fragment of shell or pebble, which it holds upon its back by its posterior claws, as other species of crabs (*Hypoconcha*) do a valve of Pecten or some other bivalve shell. Upon this small shelly or stony fragment the very young *Cancrisocia* finds a congenial abode, but soon growing too large for its station it enlarges its support by depositing a layer of horn-like material, secreted by the base, around its circumference, and this process is continually repeated in proportion to its own growth and that of the crab that carries it. In this way there is soon formed a broad thin pellicle, having its concentric elements arranged around a nucleus of stone or shell, which is usually excentric, the increase having been more rapid in front than behind. This basal secretion is held upon the back of *Dorippe* by its recurved posterior legs, in the same manner as the original bit of shell.

CANCRISOCIA EXPANSA Stimpson, l. c., p. 376, 1855.

Plate 2, figures 1, 1a.

Base very broad, oblong oval, the sides somewhat curved and the ends sub-truncate and rounded; margin crenulated. Basal secretion tough, brownish, strongly striated concentrically, the nucleus usually excentric.

Column smooth, in expansion elevated, diminishing rapidly from the base to the middle, above which it expands again to the disk, which is smaller than the base; the diameter of the middle of the column equalling half

the length of the base and two-thirds the diameter of the oval disk; in contraction a flat disk. Tentacles long, slender, tapering, subequal, arranged in two or three confused rows around the margin, the exterior ones somewhat smaller and more crowded. Mouth usually raised on a considerably elevated, broad cone, the lips with about eight strongly marked folds on each side and a sulcus at each end. Longest diameter of base two inches.

Color of column pale brownish, longitudinally lined with white. Tentacles pale brownish yellow, shaded with blackish about the middle. Mouth brownish within, the lips bright green with yellow grooves. Disk brownish yellow, radiated with blackish. One specimen varied from the usual coloration, in having the parts about the mouth pure, transparent white.

Near Hong Kong, China, only on the back of *Dorippe facchino* (?) which was common in six fathoms, mud, April, 1854. Dr. William Stimpson.

SUBFAMILY, BUNODINÆ.

Actinines verruqueuses Edw. and Haime, Corall., I, p. 263, 1857.

Family, *Bunodilæ* Gosse, 1858; *Actinologia Britannica*, p. 183, 1860.

Family, *Cereæ* Duch. and Mich., Supl. Corall. des Antilles, in Mem. Reale Accad., XXIII, p. 124 (30), 1866.

Sides of column with permanent verrucæ or suckers, which are either rounded or concave at summit, usually imperforate, but in some cases some of them are perforate and emit a jet of water when the body suddenly contracts. Tentacles usually numerous, elongated and thick; mostly contractile. Basal disk well developed.

BUNODES Gosse.

Bunodes Gosse, Trans. Linn. Soc., XXI, p. 274, 1855; *Actinologia Britannica*, p. 189.

Cereus (pars) Edw. and Haime, Coralliales, I, p. 263, 1857 (non Oken).

Anthopleura (pars) Duch. and Mich., Supl. Corall. des Antilles, p. 31, 1864 (not of 1860).

Bunodes Verrill, Mem. Boston Soc. Nat. Hist., I, p. 15, 1864; Trans. Conn. Acad., I, p. 467, 1869.

Column of uniform texture, without a distinct fold, covered with persistent verrucæ, arranged in vertical lines, usually decreasing in size and number towards the base, the upper one in each row more prominent, and forming a row of pustuliform verrucæ, or of swollen denticulations around the margin below the tentacles. Tentacles elongated, contractile, numerous. Verrucæ usually, but not always, adhesive, often concave at summit but not perforated.

BUNODES INORNATA Verrill.

Actinia inornata Simpson, l. c., p. 376, 1855.

Plate 1, figures 4a, 4b, 5.

Base broad, larger than column, which is short, cylindrical, about as broad as high. Surface of column covered with permanent, oval verrucæ, which are not very numerous, rather distantly arranged in vertical rows, most numerous above, many of the rows gradually disappearing at about the middle and but few reaching the base, where the verrucæ become more distant and less prominent. Tentacles long, curling, loosely arranged, in two or three mixed rows close to the margin, about seventy in number. They are highly contractile, not retractile, but can be enclosed by the contraction of the margin of the disk and column. Mouth elevated, with numerous lateral folds and a well developed sulcus at both ends, each bordered by a prominent, rounded lobe. Disk with a broad space between the mouth and tentacles. Height two inches.

Color dark olive, paler above, slightly brownish on the lower part of the column, darkest around the mouth.

Near Hong Kong, on a stone in gravel, at low-water mark, April, 1854. Dr. Wm. Stimpson.

In alcohol the body has a hemispherical form, the sides strongly sulcate, and minutely wrinkled transversely. The upper verrucæ are distinct, and concave; those below inconspicuous.

BUNODES JAPONICA Verrill, sp. nov.

Column with very prominent warts or verrucæ; when contracted taking the form of a thin fleshy membrane, with verrucæ arranged around a central depression. Tentacles arranged in two rows, so crowded as to encroach on each other and placed very near the margin of the disk; twelve are more prominent than the rest and nearer the mouth. Disk broad, flat. Mouth small.

Color variable, but generally uniform on all parts of the same specimen. Some are dark green, others olive, vermillion, or dark red. One was radiated with two colors.

Hakodadi Bay, Island of Jesso, Japan, on stones at and just below low-water mark, June, 1855. Dr. William Stimpson.

URTICINA Ehrenberg.

Urticina Ehr., Corall. des rothen Meeres, p. 33, 1834.

Tealia Gosse, Ann. Nat. Hist., Ser. 3, I, p. 417, 1858; *Actinologia Britannica*, p. 205, 1860.

Rhodactinia Agassiz, Comptes-rendus, XXV, p. 677, 1847 (without description); Verrill, Revision Polyps, E. Coast U. S., p. 18, 1864.

Cereus (pars) Edwards and Haimé, Corall., I, p. 263 (non Oken).

Urticina Verrill, Trans. Conn. Acad., Vol. I, p. 469, 1869.

Column low and broad, with a more or less distinct fold below the tentacles. Surface covered with small, scattered, often inconspicuous verrucæ, which are sometimes adhesive, but not perforate. Tentacles numerous, large, stout, contractile, or at least partially so. Mouth with large folds, often everted, and exposing the stomach.

URTICINA CRASSICORNIS Ehrenberg, op. cit., p. 33.

Cereus coriaceus Edw. and Haimé, I, p. 264, Pl. 1, C. I, fig. 4.

Tealia crassicornis Gosse, Actin. Brit., p. 209, Pl. IV, fig. 1, 1860.

Rhodactinia Davisii Agassiz, l. c., p. 677, 1847.

Numerous very large specimens, which do not appear to differ from the common European and north Atlantic form, were brought home by the Expedition. These were collected by Captain Rodgers in Behring's Straits and the Arctic Ocean. Specimens having the same appearance were obtained in Puget Sound by Dr. C. B. Kennerly.

It is probable that *Actinia elegantissima* and *A. Laurentii* of Brandt are identical with this species, but the descriptions are insufficient for identification. It is also probable that *Rhodactinia Davisii* Agassiz, of the New England coast, is not distinct from the European form.

URTICINA COCCINEA Verrill.

Rhodactinia coccinea Verrill, these Proceedings, Vol. V, p. 50, 1866.

Plate 1, figure 6, and Vol. V, plate 1, figure 6.

Column cylindrical, short, equalling the base; sides nearly smooth, with few, slightly prominent, inconspicuous verrucæ; below the tentacles forming a distinct fold, its upper edge with low rounded verrucæ, formed by the inflation of the skin between the radiating lamellæ. Tentacles about one hundred in number, crowded in about four rows on the disk between the mouth and margin, nearly equal in size, the interior a little larger, rather long, moderately thick, pointed. Mouth with many folds upon the lips.

Color of column uniform deep crimson; disk and tentacles lighter.

Kagosima Bay, Japan, on rocks in the second region of the littoral zone, January, 1855. Dr. Wm. Stimpson.

In alcohol the tentacles are not withdrawn, but are contracted to a short, thick, conical form, closely crowded in four or five rows. The stomach is partially everted.

The figure (Pl. I, fig. 6) does not represent a sufficient number of tentacles. They are also stouter and less marginal than there figured.

PHYSACTIS Verrill, gen. nov.

Base as broad as the disk. Column short, cylindrical, with a fold below the margin, beneath which its sides are covered with prominent and persistent scattered verrucæ; above the fold the texture is softer and smoother, and the surface is crowdedly covered with small, inconspicuous, soft papillæ or verrucæ arranged in vertical lines. Ten-

tacles not very numerous, stout, fusiform or conical, pointed, apparently not contractile and not capable of involution. Mouth prominent, strongly lobed.

Closely allied to *Urticina*, but differs from both that group and *Bunodes* in the soft and peculiar structure of the upper part of the column and in its non-contractile tentacles. The former character also separates it from *Bolocera*.

PHYSACTIS MULTICOLOR Verrill.

Actinia multicolor Stimpson, l. c., p. 376, 1855.

Plate 1, figures 4, 4c.

Base expanded, wider than the column or disk. Column subcylindrical, low, about as broad as high, in expansion, capable of contracting to less than half its usual height, upper margin nearly smooth, the fold situated about .12 of an inch below the margin, the part above this nearly smooth in full expansion, of a soft texture, and strongly contrasting in color with the rest of the body; in contraction covered with lines of small, soft, rounded papillæ, which are closely crowded. Below the fold the texture is firm, and the surface covered with many large, prominent, rounded verrucæ, which are scattered and not distinctly arranged in vertical rows, disappearing towards the base. Mouth raised on a prominent cone, the lips often everted and covered with many sulci, the opposite angles with very conspicuous grooves. Tentacles short and stout, somewhat fusiform, being constricted, somewhat, at base, and dimishing from below the middle to the ends, which are bluntly pointed and distinctly perforated, not contractile, but the margin can be contracted over and conceal them. They are arranged in two or more crowded rows, often so crowded as to become alternate in each row; about one hundred in the largest specimen. Height of column, in expansion, about one inch.

Color of the column above the fold, pink, with deep crimson, zigzag, vertical lines; below the fold purplish orange, with ten whitish longitudinal stripes; the upper

verrucae reddish brown, the lower ones blue. Mouth, disk, and tentacles bright pink or pale flesh-color.

Ly-ce-moon Passage, near Hong Kong, China, in twenty-five fathoms, gravel, April, 1854. Dr. William Stimpson.

When contracted, so as to conceal the tentacles, this species has the form of a low, broadly truncated cone, covered with verrucae, with an expanded base, and surmounted by another smaller cone, formed by the smoother submarginal area, with a concave summit. The specimens preserved in alcohol have contracted in various forms, but all have the tentacles fully exposed, though contracted in length to a stout conical form. One specimen retains nearly the normal form, as figured, others have the stomach so everted as to conceal the disk and even most of the column. The verrucae of the walls are very conspicuous.

ANTHOPLEURA Duch. and Mich.

Anthopleura Duch. and Mich., Corall. des Antilles, p. 48, Pl. VII, fig. 13, 1860; (*pars*) D. and M., in Suppl. Corall. des Antilles, p. 31, 1864.

Column elongated, subcylindrical. The walls with tentaculiform papillae near the upper margin, and below with verruciform suckers arranged in vertical rows, diminishing in size and number towards the base. The papillae and some of the upper verrucae appear to be perforated and have the power of ejecting water when the body contracts, while the others are concave but imperforate, and serve to agglutinate fragments of shell, sand, etc. Disk narrow, tentacles rather few, long, rather stout.

The known species live buried to the tentacles in sand.

This genus is closely allied to *Aulactinia* of the Carolina coast, which has the same habit of living buried in sand, and a similar arrangement of suckers and tentacles, but in the latter the marginal appendages have a more complex character, becoming tri-lobed and crenulated, thus approaching *Oulactis* more nearly.

Duchassaing and Michelotti in their later work, have modified the characters of their genus so as to include a

species (*Cladactis?* *granulifera* Verrill) with verrucæ that are neither perforated nor adhesive, and another (*Bunodes pallida* V.) in which they are adhesive but not perforated. The latter appears to agree in all respects with *Bunodes*, and differs generically from *A. Krebsii* D. and M., which was the original type of the genus. As the genus is characterized in the later work it does not differ essentially from *Bunodes*.

ANTHOPLEURA STIMPSONII Verrill, sp. nov.

Base well developed, as wide as, or wider than, the column, which is elongated, cylindrical in expansion, but capable of contracting into a subglobular form. Suckers numerous, the upper ones elongated papilliform, crowded, becoming less prominent downward; those more than a quarter of an inch from the margin verruciform, with concave summits, not crowded, forming regular vertical rows, which are mostly traceable to or below the middle, when they gradually disappear; some of them, however, extend to the base, where they become distant and scarcely prominent. Tentacles nearly equal, about sixty-four in number, in three rows, which crowd upon each other. In the first are eight prominent ones, in the second twenty-four, alternating by threes with those of the first row, in the outer row thirty-two, alternating with those of the other rows. Disk not very broad. The largest specimen, partially contracted in alcohol, is about one inch in diameter and two high; tentacles nearly .5 of an inch long. When living it doubtless becomes, in expansion, several inches higher and more slender.

Color of column pale, with a sand-colored epidermis. Mouth and disk fawn-color, with two large flake-white spots indicating the antero-posterior diameter. Tentacles of a pale whitish hue, spotted on the inside with broad flake-white blotches at the outer side of the base of each tentacle of the inner row, and at the inner base of the two adjacent outer tentacles.

Hong Kong harbor, in the fourth region of the littoral zone, attached to stones far beneath the surface of the

coarse sand, but rising above it when extended, March, 1855. Dr. William Stimpson.

ANTHOPLEURA, sp.

A species resembling the preceding. Simoda, Japan. Dr. William Stimpson.

FAMILY, *THALASSIANTHIDÆ*.

Thalassianthidæ Verrill, these Proceedings, IV, p. 148, 1865; Trans. Conn. Acad., I, p. 461, 1869.

This family includes a great variety of forms, remarkable in having branchiform organs which arise from the disk, either within or outside of the circle of simple tentacles, intermixed with them, or even wholly taking their place. These organs may be simple or variously lobed tubercles, or they may be elongated and variously branched and subdivided, foliaceous or arborescent, and often much larger than the true tentacles.

SUBFAMILY, *PHYLLACTINÆ*.

Phyllactinæ Edw. and Halme, Corall., I, p. 291, 1857; Verrill, l. c., p. 462.

Actinians having both simple tentacles, and compound, arborescent or foliaceous, tentacle-like, organs on the disk, among the simple tentacles, or at the margin of the disk, and homologous with the marginal verrucæ of *Bunodes*, and other genera. These probably have the nature of branchiæ.

AMPHIACTIS Verrill, gen. nov.

Base broad. Column covered with prominent verrucæ, arranged in vertical lines. Simple tentacles in several rows submarginal, with compound and much subdivided, short, tentacle-like organs both outside and inside of them; the latter covering the disk more or less completely.

This genus differs from *Oulactis* in having complex

tentacles (branchiæ?) *within* the circle of simple tentacles in addition to those outside. *Rhodactis* has the compound tentacles between two circles of simple tentacles. *Actinotryx* has only the compound tentacles within the circle of simple ones. *Actinodactylus* has the simple and compound tentacles intermingled, and the structure of the latter is quite different. The genus, *Actinoporus* Duch. and Mich., resembles this genus somewhat, but lacks the simple tentacles, the compound ones occupying the whole surface of the disk.

This genus is, therefore, of much interest, since it completes one of the series of possible combinations of characters proper to this subfamily.

AMPHIACTIS ORIENTALIS Verrill, sp. nov.

Base broad, divided at the edge into irregular lobes. Column of firm texture, subcylindrical, covered over its whole surface with elevated, papilliform verrucæ, which are capable of contracting to low, nearly flat suckers, with concave tops. These verrucæ are most numerous and apparently more elevated on the upper parts, and are arranged in regular vertical rows, many of which can be traced to the base, the verrucæ below the middle becoming more distant and mostly contracted. The upper part of the column forms a distinct fold, denticulated or crenulated on its edge. The outer compound tentacles are numerous, short and much subdivided, the lobes being small and rounded. The simple tentacles are elongated, moderately stout, tapering, arranged in about three crowded rows, and quite numerous. The interior compound tentacles are numerous and resemble the exterior ones, but are less subdivided, those nearest the mouth being the smallest. They cover most of the disk between the mouth and the circle of simple tentacles. Mouth large, with prominent lips, having many lateral folds. The tentacles are not contracted in alcohol, but the disk is so much withdrawn that the margin of the column partially conceals them. Height of alcoholic specimen 1.25 inches; diameter of base .1 of an inch.

Color, in alcohol: lower part of column yellowish brown; upper part greenish brown; disk and tentacles dark olive-green.

Bonin Islands. Dr. William Stimpson.

The above description has been made from a specimen well preserved in alcohol. It is doubtless somewhat contracted, but retains nearly the normal form, and all the organs are well shown.

SUBFAMILY, DISCOSTOMINÆ.

Discostominæ Verrill, Trans. Conn. Acad., I, p. 461, 1869 (non *Discosoma* Duch. and Mich., Supl., p. 27, 1864).

Column apparently without verrucæ or lateral openings. Tentacles numerous, short, often verruciform or with globose ends. Disk broad, with verrucæ, papillæ, or small tentacle-like organs, arising from the same radiating chamber with the corresponding tentacle, and often scarcely differing from it in form.

This singular group is remarkable in having the tentacles but little developed in length and often confounded with verrucæ or other organs which arise between the mouth and tentacles, and are usually arranged in radiating lines. These appear to agree in everything, except position, with the verrucæ, papillæ, and similar organs that arise from the sides of the radiating chambers along the lateral surface of the body, below the tentacles, in *Bunodes*, *Anthopleura*, and many other genera.

In addition to *Discostoma*, and the other forms here described, it appears to include *Ricordea* Duch. and Mich., which becomes compound by fissiparity; *Draytonia* D. and M., with colored tubercles outside the tentacles; and, probably, *Corynactis* Allman. Other described genera may belong here, but since authors in describing these animals have not stated whether the "tentacles," scattered on the disk, arise each from a distinct chamber, like true tentacles, it is impossible to determine their true affinities with certainty. The genus, *Aureliania* Gosse, may belong here, as also *Capnea* Forbes, but

the published figures are insufficient to determine satisfactorily.

DISCOSTOMA Ehrenberg, 1834.

Discosoma Leuck. (non *Discosomus* Oken, 1816; nec *Discosoma* Perty, 1830).

Discosoma (*pars*) Edw. and Haime, Corall., I, p. 255.

Column low, smooth, smaller than the disk and base. Disk very broad, covered with numerous rounded verrucæ or tubercles, which are arranged in regular radiating lines, apparently a single series in each line, each line corresponding to the top of a single internal chamber. Tentacles not distinct from the tubercles of the disk. Type, *D. nummiforme* Leuck.

DISCOSTOMA FUNGIFORME Verrill, sp. nov.

Plate 1, figure 7.

Base thin, broadly expanded, nearly as large as the disk. Column much narrower, low, smallest in the middle, expanding rapidly to the margin of the broad explanate disk, which has a thin, regularly scalloped and slightly undulated edge. The central region of the disk is sunken, and from the depression arises a cone, having the small sub-circular mouth at its summit. The mouth has a narrow, revolute border, which is marked by many slight sulcations. The entire disk, including the surface of the cone even to the lips, is closely covered by an immense number of small rounded tubercles, which are subequal and arranged in many narrow radiating series, between which the internal lamellæ may be seen through the disk-membrane, as narrow, dark, radiating lines. The tubercles are mostly closely crowded in a single row in each series, but in some cases are so crowded as to form two alternating rows. Breadth of disk, in alcohol, .8 of an inch; height .3 of an inch.

The above description has been prepared from specimens preserved in alcohol. The disk and tentacles do not appear capable of contracting. Young specimens,

.25 of an inch across the disk, are relatively higher, but the disk considerably exceeds the column. The tubercles are much fewer and relatively larger and plainly arranged in single radiating series.

The figure, though drawn from life, represents the base as altogether too narrow and the tubercles not sufficiently numerous.

Color variable, usually purple, often light green.

Port Lloyd, Bonin Islands, attached to branches of *Madrepora*, in one fathom. Dr. Wm. Stimpson.

This species resembles *Ricordea florida* D. and M., but the latter becomes compound, having several mouths when adult.

HOMACTIS Verrill, gen. nov.

Column low, cylindrical, with a distinct fold near the margin, substance firm, surface smoothish. Disk not much wider than the column, concave, the whole surface, except a narrow region about the mouth, covered with small, rounded, perforated tubercles, arranged in wide radiating series, in which they are crowded in several transverse rows. Tentacles marginal, in life longer, with imperforate tips; in alcohol scarcely different from the tubercles in appearance. Mouth large.

HOMACTIS RUPICOLA Verrill, sp. nov.

In alcohol the base is equal in width to the column, which is low, cylindrical, with many strongly marked transverse folds due to contraction, which are crossed by fine longitudinal wrinkles. Just below the tentacles is a well marked fold; substance firm. Disk broad, but scarcely exceeding the column, deeply concave, covered by about fifty broad, radiating groups of very small and numerous, rounded, perforated tubercles, which are closely crowded and form four or five irregular transverse rows in each radiating band. These radiating groups correspond with the internal chambers, and the principal ones extend from near the mouth to the circumference. Between these are smaller ones, some of which extend half

way to the centre and others much less. The marginal tentacles can scarcely be distinguished from the other tubercles in the alcoholic specimen, but in life are "longer, flattened, with broad, white, imperforate tips." Mouth large, with thickened lips, which have many small folds, with two rounded tubercles at one angle. Height, in alcohol, .5 of an inch; diameter .1 of an inch.

Sides of column, in life, greenish gray, streaked with pinkish brown towards the base. Disk greenish gray, with the margin of the mouth white. Marginal tentacles with white tips.

Hong Kong, attached in crevices of the rocks in the fourth region of the littoral zone, March, 1855. Dr. Wm. Stimpson.

STEPHANACTIS Verrill, gen. nov.

Column subcylindrical, somewhat elongated, not verrucose, substance firm and dense. Disk exceeding the column, covered with regular radiating lines of short, unequal tubercles. The outer tubercles or tentacles are largest and divided into several (three to five) short rounded lobes; those next within are two or three lobed; the innermost are simple, rounded or papilliform verrucæ. The disk and tentacle-like organs do not appear to be capable of contraction, being fully expanded in alcohol.

This genus resembles in general appearance *Actinoporus* Duch. and Mich., but does not have the tentacular organs subdivided as in that genus, nor the walls perforated by vertical rows of pores (suckers?). The tentacle-like tubercles resemble, in form and arrangement, those of *Aureliania* Gosse, but are more numerous, and the latter is said to be highly contractile in all parts, and appears to differ in other characters from the present form. It may, however, eventually prove to be the same genus.

STEPHANACTIS INDICA Verrill, sp. nov.

In alcohol the base is narrower than column, the latter is largest in the middle, decreasing towards the summit,

longer than broad ; its texture firm and dense, its surface longitudinally sulcate, with rather wide ridges, which are crossed by deep transverse wrinkles due to contraction, the surface closely lined by fine vertical wrinkles. Edge of disk exceeding the column and a little revolute, the upper surface covered by about forty radiating rows of short unequal tubercles, five or six in each row, the rows being alternately wider and narrower, the wider ones projecting beyond the outer edge more than the narrower ones, and terminating in a three-lobed or tridentate tubercle, the middle lobe being longest ; upon the inner side of this are two small rounded median tubercles, followed by a deeply bilobed tubercle, which is succeeded by three or more, simple, verruciform tubercles, extending to near the mouth. The narrower rays terminate outwardly in a shorter and much smaller tubercle, with a pointed central lobe, the two lateral ones being scarcely developed ; on the inside of this are two small, median, rounded tubercles, often slightly bilobed, followed by a more elevated bilobed tubercle, which is succeeded by three or more small, usually simple, rounded tubercles. Mouth in the alcoholic specimen much protruded and everted. Height of the preserved specimen .6 of an inch ; diameter of column .4 of an inch.

Selio Island, Gaspar Straits, February, 1854. L. M. Squires.

CORYNACTIS Allman, 1836.

Corynactis (pars) and *Melactis* Edw. and Haime, Coralliaires, I, pages 258 and 260, 1857.

Column smooth, versatile in form. Disk much expanded, convex or concave, with the mouth depressed or elevated on a cone, according to the state of contraction. Tentacles more or less scattered on the disk, the outer ones largest, with a pedicel and an enlarged or globose tip. Whether more than one of these organs arise from the same chamber, I am, at present, unable to determine, but this seems probable from the figures.

The following species, and also *C. viridis* of Europe,
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protrudes and retracts the mouth at will, therefore the genus, *Melactis* E. and H., which was based on the prominent mouth of *C. vas* and *C. globulosa*, as figured by Quoy and Gaimard, must be dropped, unless sustained by other characters at present unknown.

CORYNACTIS ANNULATA Verrill.

Melactis annulata Verrill, these Proceedings, Vol. V, p. 50, Pl. 1, figs. 8, 8a, 1866.

Base expanded, entire or lobed. Column smooth, at times short cylindrical, in full expansion usually smallest in the middle, gradually enlarging both to the base and summit. Disk in full expansion wider than the column, sometimes convex, at other times concave. Mouth small, rounded, either depressed or raised on a prominent cone, the lips with many radiating folds. Tentacles occupying the outer half of the disk, the inner ones short, tuberculiform, scattered, the outer ones much larger, somewhat elongated, the pedicel nearly as thick as the slightly enlarged, rounded end. Height, in expansion, .4 of an inch; diameter of disk .32 of an inch. Color of column light rose, with a narrow ring of bright vermilion just below the tentacles, at the margin. Mouth, disk, and tentacles nearly white, tinged with rose.

False Bay, Cape of Good Hope, abundant on stones and shells on rocky bottoms, in fifteen to twenty-five fathoms, October, 1853. Dr. Wm. Stimpson.

ADDITIONS AND CORRECTIONS.

SINCE printing the earlier parts of this Synopsis several changes in the genera have become necessary, while some additional specimens have been found, belonging to the collection, which were previously overlooked. In order to illustrate more fully the coral faunæ of some of the localities visited, I have also added a few species not collected by the Expedition, which are new or little known. These are all in the Museum of Yale College.

ALCYONARIA.

GORGONIDÆ.

LITIGOGIA CUSPIDATA Verrill, Trans. Conn. Acad., I, p. 403, = *Leptogorgia cuspidata* V. (Vol. IV. p. 186).

GORGONIA ALBICANS K  lliker. — The peculiar specimen mentioned under *Lophogorgia palma* E. and H. (p. 187) proves to belong to this species.

PLEXAURIDÆ.

EUPLEXAURA Verrill, gen. nov.

The species referred doubtfully to *Plexaura friabilis* Lamx., has spicula that differ widely from those of *Plexaura*, and although they approach those of *Plexaurella* more nearly, they differ so much as to render it impossible to refer the species to that genus without modifying its character considerably. Therefore I propose to consider it the type of a new genus.

In external characters it resembles *Plexaurella*, with rather large, open cells. The spicula are mostly short, stout, blunt, warty spindles, of rather small size, with a

few small, simple double-spindles, and rarely, small, irregular crosses.

Plexaura differs in having long, acute spindles, some of which are usually very large, mingled with others that are much smaller, and small warty clubs. *Plexaurella* has mostly rather small, warty double-spindles, mingled with numerous warty crosses of similar size, with central naked bands.

EUPLEXAURA CAPENSIS Verrill, sp. nov.

Plexaura friabilis Verrill, Vol. IV, p. 186; (*pars*) Lamouroux?

This is not the *P. friabilis* of Edw. and Haime, Duch. and Michelotti, Kölliker, and other modern writers, and may not have been known to Lamouroux. It is probable, however, that he confounded more than one species under that name, and his East Indian specimens may be this species. As the name is generally given to a West Indian *Plexaura*, it seems best to give a new one to this.

Spicula small, mostly short, oval or oblong, and crowdedly covered with large, very rough warts, which are mostly dilated and echinulate at the summits. Others are similar, but shorter, and approach the form of warty heads. Others approach the form of short, thick double-spindles, with two wreaths of large rough warts near the middle, and a terminal cluster of smaller ones at each end. Occasionally there are compound cross-spicula, about as broad as long, the ends thickly covered with large, very rough warts, and rather obtuse or truncated.

The stout spicula measure .204 millimetres by .108 millimetres; .180 by .108; .180 by .096; .180 by .084; .168 by .096; .156 by .096; .144 by .108; .144 by .096. The stout double-spindles .156 by .108; .144 by .072; .132 by .096 .120 by .072. The crosses .120 by .120; .144 by .108. Heads .144 by .108.

PRIMNOIDÆ.

The recent discovery of several genera intermediate between *Muricea* and *Primnoa* (*Echinogorgia*, *Paramuricea*, *Acis*, *Thesea*, etc.) renders it necessary to unite the

two groups in one family. The *Plexauridæ* would then include only *Plexaura*, *Eunicea*, *Plexaurella*, and allied forms.

MURICEA FLEXUOSA Verrill, Amer. Jour. Science, Vol. 45, p. 412, May, 1868, = *Lissogorgia flexuosa* V. (Vol. IV, p. 187).

The genus, *Lissogorgia* V., based upon the *Gorgonia cancellata* Dana, seems unnecessary, since the typical species proves to belong to *Paramuricea* K  lliker, a genus established at nearly the same time and based upon more important characters. *Villogorgia* and *Blepharogorgia* (*pars*) Duch. and Mich. appear to be other synonyms, but the typical species of the latter may, perhaps, form a distinct genus. (See American Jour. Science, Vol. 45, p. 413 and Vol. 46, p. 143.)

In this Family the forms and structure of the spicula appear to be the safest guides to the true affinities of the species. In the recent very valuable and important work* of Dr. Albert K  lliker, the spicula of most of the genera are beautifully illustrated.

ASTROGORGIA Verrill.

American Journal of Science, Vol. XLV, May, 1868, p. 414.

C  nenchyma and surface of verruc   granulous and composed of rather small spindles, closely united together, with some irregular, small, rough double-heads and clubs. Verruc   prominent, eight-rayed in contraction, the spicula being arranged in eight groups. Tentacles often not wholly retracted, their bases strengthened by eight groups of conspicuous, fusiform spicula, similar to those of the c  nenchyma, arranged in V-shaped lines. When the tentacles are nearly withdrawn the basal spicula form a stellate figure at the mouth of the cell.

ASTROGORGIA SINENSIS Verrill, op. cit., p. 412, = *Muricea Sinensis* V. (Vol. IV, p. 187, Plate 5, figure 5, 5a.)

The verruc   in this species form broad, low, rounded cones, or are nearly hemispherical. The spicula in the

* Icones Histologic  , zweite Abtheilung, Leipzig, 1865.

bases of the tentacles are red and conspicuous, like those of the cœnenchyma. Spicula mostly light red with some grayish yellow. Longer spindles long, often bent, gradually tapering to the ends, which are slender and acute, covered over the whole length, with rough truncated projections, which are largest in the middle and diminish to each end. Shorter spindles considerably stouter, with more crowded projections, often with one end obtuse and the other acute, smaller spindles slender, rather acute, with unequal scattered warts. Irregular spicula frequently composed of a slender axis, naked in the middle, with an irregular group of four or five large, rough, somewhat subdivided warts at each end; others have similar warts scattered over the whole length; others have large rough warts at one end, which gradually diminish towards the other end, where they are quite small, thus producing a somewhat club-shaped form. A few very small, simple, cross-shaped spicula occur.

The longer spindles measure .420 millimetres by .090. millimetres; .372 by .084; .360 by .096; .348 by .084; .324 by .096; .300 by .072. The stouter ones .288 by .084; .288 by .072; .264 by .084. The smaller ones .228 by .084; .216 by .042; .180 by .060; .180 by .048. Irregular ones .144 by .072; .108 by .060; .108 by .048; .096 by .060.

ANTHOLOGORGIA Verrill, op. cit., p. 412.

Verrucæ prominent, tubular, the summit eight-rayed in contraction, formed by a thin integument, in the surface of which, large, long, mostly bent spindles are imbedded at various angles, and so interlaced as to form a sort of network of spicula, with depressions between. Cœnenchyma thin, granulous, filled with large, warty spicula, similar to those of the verrucæ, but usually shorter and stouter.

ANTHOLOGORGIA DIVARICATA Verrill, op. cit., p. 412, = *Muricea? divaricata* V. (Vol. IV, p. 188, Plate 5, fig. 6, 6a.)

The enlarged figure of the verrucæ (Plate 5, fig. 6a) does not represent the spicula properly. They should be

much more numerous, covering the whole surface, and interlaced at all angles, leaving small, often nearly square depressions between. Spicula white, mostly long, rather slender, often curved spindles. The longer ones taper gradually towards the ends, which are not very acute; they are covered on all sides with closely crowded, rather regular, conical warts. Some of the smaller spindles have the warts less crowded and more regular. The stouter spindles are frequently somewhat oblong in outline, being of nearly uniform size to near the ends, where they taper abruptly; their warts are larger, rough, often lobed, unequal, and closely crowded. Besides these there are many short, thick, irregular spicula, covered with very unequal, rough, irregular warts.

The longer spindles measure .552 millimetres by .108; .516 by .084; .504 by .072; .492 by .096; .480 by .096; .480 by .084. The stouter spindles .540 by .120; .456 by .144; .420 by .096; .432 by .120; .324 by .072. The irregular spicula .252 by .108; .204 by .120.

ECHINOMURICEA Verrill.

American Journal of Science, Vol. 47, p. 285, March, 1869.

This genus has been established for the following remarkable species, which appears to be sufficiently distinct from *Acanthogorgia* and *Paramuricea*, to both of which it is allied. It is peculiar in having the verrucæ surrounded at base by numerous very long, stout, thorny and branched, spine-like spicula, which are crowded and somewhat imbricated, not placed in whorls.

ECHINOMURICEA COCCINEA Verrill, l. c., p. 285, = *Acanthogorgia coccinea* V. (Vol. IV, p. 188, Pl. 6, fig. 7, 7a).

ISIDÆ.

PARISIS LAXA Verrill, Vol. IV, p. 190.

This species occurs, also, as I am informed by Dr. Lutken, in Formosa Channel.

MOPSELLA JAPONICA Verrill, Vol. IV, p. 190.

Specimens of this species, from Hakodadi and Bay of Yeddo, recently received from Mr. W. H. Dall, differ somewhat from the type.

They are more densely branched, the branches less divergent and often coalescent, leaving large irregular openings. The branches and branchlets are also stouter, crooked, obtuse at the ends. Verrucæ mostly crowded on the edges of the branches, often entirely covering the smaller branchlets but generally scattered or wanting on the sides of the larger branches. They are relatively larger, rather prominent, round, with depressed and concave summits, showing in the centre a cluster of convergent, bright yellow polyp-spicula. Cœnenchyma finely but roughly granulous with small rough spicula.

One specimen is bright lemon-yellow, the others deep red.

One specimen is 2.25 inches high and 2.75 broad; another is 3 inches high and 1.5 broad. [Diameter of larger branches at internodes .10 to .12 of an inch; of branchlets .06 to .08; length of terminal branchlets rarely more than .30; distance between branches usually .25 to .35; diameter of verrucæ .04 to .05.

ALCYONIDÆ.

ALCYONIUM? Verrill, Vol. IV, p. 191, = *Lobularia Verrillii* Gray; Annals and Mag. Nat. Hist., Series 4, Vol. 3, p. 121, Feb., 1869.

This species is, as yet, known only from a small and imperfect specimen. Not having had an opportunity to examine its spicula, I am unable to refer it to its proper genus. It cannot belong to *Lobularia* as defined by Dr. Gray. Sea of Ochotsk.

NEPHTHYIDÆ.

EUNEPHTHYA Verrill.

American Journal of Science, Vol. 47, p. 284, March, 1869.

This genus, established for the following species and *E. glomerata* from Greenland, is peculiar in having the

verrucae prominent and covered with rough, thorny, club-shaped or branched spicula, with the ends projecting from the surface.

Nephthya has the verrucae covered with long, regular, or curved, warty spindles, appressed to the surface.

EUNEPHTHYA THYRSOIDES Verrill, l. c., p. 284, = *Nephthya thyrsoides* V. (Vol. IV, p. 192, Pl. 6, figs. 8, 8a, 8b).

Spicula mostly long, thorny, club-shaped, .600 of a millimetre to 1.00 long, by .100 to .200 thick; and stouter very thorny clubs, .300 to .500 long, by .125 to .250 broad; and rough, sharp, three-pronged spicula, .275 to .325 long, by .150 to .250 broad. The thorny ends of these spicula project from the surface of the verrucae, especially towards their summits, giving it a very rough appearance.

Dr. Gray, in the work cited above, erroneously places this species as a synonym of *Verrilliana thyrsoides* Gray (*Ammonothea thyrsoides* Ehr.), from which it differs widely.

SPONGODES CAPITATA Verrill (Vol. IV, p. 193), = *Spoggodes capitata* Gray, op. cit., p. 128.

SPONGODES GRACILIS Verrill (l. c.), = *Spoggodia gracilis* Gray, op. cit., p. 128.

The genus *Spoggodia* Gray (non Dana), has been separated from the typical species, owing to the more scattered arrangement of the polyps, "prominent from the sides or forming the tips of the branchlets." These characters seem to me insufficient for the establishment of a genus. Moreover *S. gigantea* V. (Vol. IV, p. 192) combines the characters of the two groups, having both single polyps scattered on the sides of the branchlets and others clustered at the ends and surrounded by large, spine-like spicula.

According to the generally accepted rules of orthog-

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raphy, the name of this genus should be *Spongodes* (or *Spongodia*) not *Spoggodes*, or *Spoggodia*.*

CORNULARIDÆ.

TELESTO RAMICULOSA Verrill (Vol. IV, p. 194), = *Telesco ramulosa* Gray, op. cit., p. 22.

TELESTO? NODOSA Verrill (l. c.), = *Telescella nodosa* Gray, op. cit., p. 22.

Dr. Gray has proposed for this doubtful species the subgenus, *Telescella*, based on its peculiar mode of branching. This appears quite unnecessary, especially until the species is better known.

A microscopic examination of one of the original specimens recently received from the Museum of Comparative Zoölogy shows that, in all probability, it does not belong to the Alcyonaria, since there are no spicula whatever. When treated with caustic potash the tubes are seen to consist of an amorphous membranous basis, with various foreign substances—minute grains of sand, Foraminifera, Diatoms, etc.,—imbedded in it, the annulations of the tubes being thicker ridges of the amorphous material, which is insoluble, or nearly so, in caustic potash. In some parts there are minute, nearly spherical, nucleated cells, either scattered, or closely grouped in a single layer.

The condition of the specimens does not admit a reliable determination of their nature. They may be tubes of some annelid, or small crustacean, since many genera of Amphipods, like *Cerapus*, make similar tubes.

There appears to be no sufficient reason for Dr. Gray's change in the spelling of this generic name.

* See Section 14 of the Rules of Zoölogical nomenclature adopted by the British Association, 1865; also reprinted in the American Journal of Science, July, 1869.

MADREPORARIA.**MADREPORIDÆ.****MADREPORA MICROPHIALMA Verrill, sp. nov.**

Corallum numerously divided, somewhat arborescent, the branches subpinnate, spreading mostly in one plane, proliferous towards the ends, covered with small, unequal, tubular corallites, which have very small, circular, regularly stellate cells, surrounded by thickened borders.

The main trunk gives off branches subpinnately on two sides, which diverge rapidly and are usually less than a quarter of an inch apart. A few smaller branches also rise from the front and back sides of the trunk and main branches, which do not conform to the common plane of the other branches; the secondary branches and branchlets arise somewhat irregularly from the larger branches, varying from .12 to an inch or more apart below, but becoming crowded and strongly divergent near the ends. The branches and branchlets taper rapidly to the tips, which are subacute and terminated by a small, slightly prolonged terminal corallite, of quite porous but firm texture, rounded at tip and perforated by a very small cell, which is regularly stellate with six primary septa that meet at the centre and other rudimentary septa of the second cycle between them. Lateral corallites very unequal in size and elevation, diverging at an angle of about 45° , tubular, somewhat tapering, truncated a little obliquely at summit and rounded, the border of the cell considerably thickened, especially on the outside, the texture firm but very porous and spongiform, the surface evenly echinulate, not costate. The cells are very small, regularly stellate, with six, well-developed, equal septa, which nearly meet at the centre. Cœnenchyma firm, finely echinulate.

Height 4.25 inches; breadth 6; diameter of larger branches .45; of terminal branchlets .25 to .30; length of the latter .50 to .75; length of terminal corallites .10; diameter .08 to .10; diameter of cell .02; length of lateral corallites .02 to .15, the average about .10; diame-

ter .02 to .07, average about .06; diameter of largest cells about .015.

Loo Choo Islands. Rev. S. W. Williams.

This species is allied to *M. formosa* Dana; *M. brachiata* Dana; *M. laxa* Lam.; and *M. gracilis* Edw. and Haime, but differs from all in having much smaller cells, as well as in its mode of branching. The first has longer, more slender and acute, and scarcely proliferous branches, with much longer and more slender corallites, which are more nearly equal and not crowded nor thickened, with much larger cells. The surface is more porous and more coarsely granulous. *M. brachiata* has much stouter and less subdivided branches, with much longer corallites, which are crowded, less unequal, and obliquely truncated at summit, with oval and large cells. *M. laxa* differs in its mode of branching and larger verrucæ and cells. *M. gracilis* has nariform corallites.

M. arbuscula resembles it somewhat in mode of branching, but has stouter branches and much larger cells and corallites, and its surface is coarsely porous and scabrous, costate on the corallites.

MONTIPORA EXESA Verrill, sp. nov.

Montipora foliosa? (Vol. V, p. 25), non Edw. and Haime.

Since describing this coral I have been able to examine a large and fine specimen of *M. foliosa* and must regard it as a distinct, though allied, species.

This resembles it in the character of the lower surface, and probably, also, in its mode of growth, but differs in having on the upper side much coarser, thicker, and round-topped papillæ, most of which are united more or less into groups, crests, and long ridges, which are united by thin cross ridges, so as to form very unequal and irregular deep pits over the whole surface, which give it a rough, eroded and excavated appearance. The cells are inconspicuous, very small (scarcely .02 inch), and situated at the bottom of the pits and often among isolated papillæ. They have six larger septa alternating with six very rudimentary ones. The external surface is very

porous and spongy, not papillose, and covered with more distinct and larger cells (about .03 inch), which are surrounded by a thickened, roughly spinulose and porous border, somewhat elevated above the general surface. They are numerous but irregularly scattered, and have twelve distinct septa, six of which are larger.

Gaspar Straits.

MONTIPORA FOLIOSA Edw. and Haime.

Madrepora foliosa Pallas, 1766 (*non* Ellis and Solander, 1786, *nec* Esper, Tab. LVIII B, fig. 1, 2, 1797).

Porites rosacea Lamarck, 1816 (*non* Lamouroux, Plate 52).

Montipora foliosa Edw. and Haime, Corall., Vol. 3, p. 212 (*non* *Porites foliosa* Ehr., *nec* *Manopora foliosa* Dana).

A specimen of this species, in the Museum of Yale College, consists of a large cluster of very broad, thin, convolute, unequal fronds, which are arranged somewhat like the petals of a half-blown rose, but are somewhat irregular in form and position. There are three fronds between the centre and the outside on nearly all parts. The spaces between the fronds at the summit, vary from 2 to 3.5 inches. Some of the fronds are 20 inches broad, and over 12 wide. The entire height of the coral is 14 inches; diameter 18. The fronds are thin throughout, scarcely exceeding .25 of an inch in any part, and usually about .12 at one or two inches from the margin, which is much thinner and translucent. Texture very porous, rather fragile. On the outside the surface for an inch or more from the margin is nearly destitute of cells and not papillose, but crossed by irregular and very unequal, distant, vertical ridges. Below this the cells gradually become more numerous and crowded, and the surface more uneven. The cells are between .02 and .03 of an inch in diameter, slightly elevated, and surrounded by small, rounded, rough papillæ, and with similar minute papillæ between. Septa small, six distinct. On the inner surface the cells are of about the same size, but are surrounded by much higher, very slender, rough papillæ, while similar but shorter papillæ are thickly crowded over the whole surface between the cells. Towards the

margin the papillæ form longitudinal rows, or narrow crests. Septa twelve; six larger, alternating with very small ones.

(?) Ceylon. Rev. G. A. Aphorp.

This fine species has been so often confounded with several others that are similar in form or mode of growth, that it seems useful to add the above particulars from a specimen that appears to agree with the typical form described by Pallas, and also by Edwards and Haime. The *Montipora grandifolia* of Dana, of which the original specimen is before me, is very closely allied to this and may be only a variety of it. The character of the upper surface is identical in nearly all respects, but the lower surface has more numerous cells, which extend to the margin, or nearly so, and are somewhat more prominent and a little larger, with the septa more developed, the primary ones a little thickened, alternating with six narrower secondaries. The texture appears firmer and the surface less rough and scarcely papillose, even around the cells.

The species described as *Porities foliosa* by Ehrenberg, and afterwards adopted by Dana, appears from the description to be quite distinct.

MONTIPORA LICHENOIDES, Verrill, sp. nov.

Corallum encrusting below, explanate above, rising into irregular, thin, more or less contorted, plicate or crispate fronds. Near the margin the fronds are about .05 of an inch thick, the exterior for about an inch from the margin is covered with irregular vertical ridges or plications, with small scattered papilliform processes, which become more numerous and larger below, where they frequently unite into larger compound papillæ, between which are smaller rounded ones thickly scattered over the surface. The cells are very small, about .01 of an inch, and are irregularly scattered among the smaller papillæ, on the bases of the larger ones, or elevated among the summits of the compound ones; towards the margin they are remotely scattered over the surface and wholly immersed. Septa

twelve, six well developed and a little thickened, alternating with six very narrow ones. The upper surface of the frond is covered, on the lower part, with very unequal, densely crowded, slender, round-topped papillæ, which are mostly united in irregular clusters; towards the upper part of the fronds the papillæ stand in vertical rows or clusters, which near the margin unite and form thin, elevated costæ or crests, the edges of which are divided more or less into thin and compressed, or round and slender papillæ, which have rounded summits, sulcated sides, and a minutely roughened surface. The cells of the upper side are not numerous, distantly scattered among the papillæ and between the crests, quite small and inconspicuous, but larger than those of the lower surface; diameter about .02 of an inch. Their septa are well developed, as in those of the lower side.

The only specimen seen is about four inches in breadth and the same in height, the free portions of the frond rising about two inches. It encrusts the branches of a dead *Madrepora*.

Loo Choo Islands. Rev. S. W. Williams. Museum of Yale College.

This species is allied to *M. foliosa*, *M. exesa*, *M. grandifolia*. The cells are, however, much smaller than in either of those species, especially upon the lower side, and its texture is more firm and solid, while its lower surface is more papillose. Its upper surface is quite unlike any except *M. exesa*, but even that species has the papillæ more regular and the surface more distinctly divided into areolations by the elevations, while the papillæ themselves are much shorter, thicker, more obtuse, and more completely united.

MONTIPORA PATULA Verrill, sp. nov.

Corallum thin, partially explanate, attached and encrusting at the centre, the edges free and nearly horizontal for a width of four inches or more. The corallum at half an inch from the edge is .15 of an inch thick; at 3 inches, .30; texture very porous but tolerably firm.

The lower surface is destitute of papilliform processes, and nearly even, composed of a very porous spongiform tissue, roughened with minute sharp points. The cells are very small (.01 inch), regular, wholly immersed, surrounded by a circle of small spinules, thickly scattered over the surface, except towards the edge where they are generally more distant and often larger, usually with twelve very small, rudimentary septa. Upper surface very porous, somewhat undulated, a little uneven, thickly covered with small, unequal, prominent, round-topped papillæ, which have a very open spongiform texture, their surface covered with rough projections. Sometimes these papillæ are less developed and appear like small rounded clusters of spongy trabiculæ, which project all over the surface and are lacerately divided. Cells thickly scattered over the surface, each usually surrounded by a cluster of four or five of the larger papillæ, considerably larger than those of the lower side (about .03 of an inch), with six quite distinct septa, which extend about one-fourth across the cells. Towards the central parts of the coral the cells are generally somewhat larger and have twelve septa, six very narrow ones of the second cycle alternating with the six larger primary ones.

Close to the edge the papillæ sometimes form radiating rows, or unite into short, thin ridges. The largest papillæ are scarcely .02 of an inch in diameter, and about .04 in height.

Hawaiian Islands. Museum of Yale College. Numerous specimens are also in the Museum of Comparative Zoölogy, which were collected by Mr. A. Garret.

This species appears to grow in broad horizontal fronds, having an undulated surface, and attached or encrusting in the central parts, the edges becoming free. In the character of the upper surface it resembles somewhat *M. grandifolia* Dana, and *M. expansa* Dana, but has a much more porous texture and thicker and rounder papillæ, but both the latter species have a very different lower surface, with prominent cells, which are three or four times broader, and their fronds are thinner and firmer. The even, nearly smooth lower surface, with minute punc-

tiform cells, is quite unlike that of most other known species.

TURBINARIA DICHOTOMA Verrill, sp. nov.

Corallum large, dichotomously branched. Branches stout, subcylindrical, often flattened at the end, covered with large, somewhat prominent corallites, which open upward and are uniformly scattered on all sides of the branches, but become crowded and unequal at the ends, where many small corallites are seen among the larger ones, from which they appear to rise by interstitial or extramarginal budding. The lateral cells are about a quarter of an inch broad, shallow, nearly circular, and arranged in five or six, irregular, vertical or somewhat spiral rows, those in the same row mostly from .3 to .4 of an inch apart, while those of adjacent rows are often less than their own diameter apart. The cells are elevated on low, broad eminences, which spread at their bases and are so closely appressed to the sides of the branches that the cells open obliquely upwards. Cœnenchyma roughened with papilliform and small spinous processes, intermingled with others which are of various irregular forms, often crest-like, or variously convoluted, narrow ridges. Among the interstices of these are numerous irregular pores, which are larger than in most other species. Septa in four cycles, usually, in the larger cells, with some rudiments of the fifth cycle, the number varying from fifty to sixty; those of the first two cycles nearly equal, about one fourth as wide as the cell, the inner border perpendicular or a little concave, the summit obliquely truncated, not exsert, the upper end joining the margin and becoming confused with the irregular, spinose processes of the cœnenchyma, which cover the exterior of the corallites and form the border of the cells. Septa of the third cycle about one quarter narrower; those of the fourth and fifth cycles very narrow and often rudimentary, alternating with the wide ones of the preceding cycles. Columella broad, occupying about half the breadth of the cells, its surface convex, formed by

numerous small, rough, convoluted, and intricately united trabiculæ, with small, irregular openings among them, the free ends of rough papilliform processes forming the surface. Color of the unbleached coral dark brownish black. Diameter of the terminal branches 1 to 1.25 inches; diameter of lateral cells .20 to .25; depth .08 to .10. The terminal cells are mostly smaller and relatively much deeper.

Locality unknown, most probably Bonin or Loo Choo Islands. Dr. Wm. Stimpson.

POCILLIPORIDÆ.

Observations upon the polyps have shown that this family has the structure of the *Madreporaria*, and no affinity with *Milleporidæ* and similar Hydroid corals.* The twelve well-developed and regular septa, seen in such species as *P. elongata*, *P. stellata*, *P. plicata*, etc., also give ample evidence of their intimate relations to the true Polyps, and are inconsistent with Hydroid structure. Occasionally a cell divides by fissiparity, and in that case has twenty-four septa just before division. The transverse plates have a concentric structure and are often seen incomplete, with a round or oval opening through the centre. It appears worthy of separation from *Favositidæ* on account of the imperforate walls, abundant cœnenchyma and other characters.

POCILLIPORA GRACILIS Verrill, sp. nov.

Corallum cæspitose, low, and densely branched, the branches slender round, rarely with intervals of a quarter of an inch between the branchlets. The branches and branchlets are dichotomous and diverge at acute angles. The terminal branchlets are rarely a quarter of an inch long, about .08 of an inch in diameter, with obtuse or rounded tips. Cells shallow, .03 of an inch in diameter, or a little less, with a small, prominent columella, and

* On the Affinities of the Tabulate Corals, by A. E. Verrill, Proc. of the American Association for Advancement of Science, 1867, p. 148.

twelve very narrow, rudimentary septa, six of which can usually be traced across the bottom of the cell to the columella. Spaces between the cells usually less than their diameter. Surface of the cœnenchyma covered with very small, scattered, rough points. Color of unbleached coral light brownish yellow. Height 2.5 inches; breadth about the same; diameter of the main branches .25 of an inch.

Loo Choo Islands. Dr. Wm. Stimpson.

This species is allied to *P. cœspitosa* Dana, from the Sandwich Islands, but the latter has larger cells, which are much more closely crowded near the ends of the branchlets, leaving only a thin wall between, therefore becoming polygonal, and the columella is not distinct. The terminal branchlets are also more angular and pointed, more irregular, and have the cells opening obliquely upward. *P. bulbosa* Lam. has much longer and stouter branches, which are less subdivided and more angular at the ends. Its cells are still larger and towards the ends of the branches they are oblong-polygonal, with only thin walls between them, and open obliquely upward.

POCILLIPORA CÆSPITOSA Dana.

Pocillopora brevicornis (pars) Dana; Edw. and Halme (non Lamarck).

The Museum of Yale College possesses a large and fine series of this species from the Hawaiian Islands, collected by Mr. Horace Mann, and also several of the original specimens described by Prof. Dana. One specimen from the U. S. Exploring Expedition, labelled *P. brevicornis* by Dana, differs from the ordinary form in having the branches shorter and thicker, with the branchlets shorter and more crowded upon their enlarged ends, thus producing a thicker and lower clump than usual. But in the series there are various intermediate forms between this and those with long branches and slender spreading branchlets. Like most specimens of this species from the Hawaiian Islands, it has the large, flat, open bulbs made among its branches by *Harpalocarcinus marsupialis* Stimp-

son,* which renders it probable that this specimen was from that locality. I am not aware that *P. brevicornis* has been attributed to those Islands by any other author, and hence infer that the species does not really occur there, since it was not in the extensive series of *Pocilliporæ* collected by Messrs. H. Mann and W. T. Brigham, nor the large collection made by Mr. A. Garret at the same place for the Museum of Comparative Zoölogy.

POCILLIPORA BREVICORNIS Lamarck.

Pocillopora brevicornis (pars) Dana, *Zoöph.*, p. 526, Pl. 49, fig. 8; Edw. and Haime, Vol. 8, p. 304.

Two specimens from Ceylon, collected by Rev. G. A. Apthorp, are in the Museum of Yale College. These are the original Ceylon specimens described by Dana. They agree well with the later description by Edwards and Haime, and appear, therefore, to represent the typical form of this species. They are also quite distinct from the specimen referred to the last species, with which they were probably not directly compared by Prof. Dana, since that specimen was not sent here until long after his work was published.

This species differs from *P. cæspitosa* in its branches, which are much more equal and regular in length and size, and rise more nearly parallel, leaving more uniform spaces between, and are also longer and less subdivided, the branchlets taking the form of ascending, elongated, sometimes proliferous verrucæ, which are often appressed on the sides, but are shorter and crowded on the summits of the branches. The cells are larger and much more crowded on the sides of the branches, seldom becoming circular. The septa are rudimentary, and the columella usually wanting, the cells on the sides of the branches being usually shallow, with a nearly flat bottom.

* For an account of this singular parasite, see the American Journal of Science, Vol. 44, p. 126, 1867. I have noticed a similar parasite on *P. elongata* Dana, from Ceylon, near the top of one of its very thick branches, but never among the thick-branched *Pocillipores* of the Hawaiian Islands.

The texture is less firm, and the coral is more cellular and lighter than in *P. cæspitosa*.

One specimen has a bulb similar to those made by *Harpalocarcinus marsupialis*, but belonging, probably, to another species of the same genus, since it differs considerably in form. The aperture is closed, except a few small openings above. A similar bulb occurs on *P. elongata* Dana, from Ceylon.

POCILLIPORA DANÆ Verrill.

Pocillopora favosa (pars) Dana, Zoöph., p. 528, Plate 50, fig. 1 (non Ehr.; Edw. and Haimé).

Pocillopora Danæ Verrill, Bulletin Mus. Comp. Zoölogy, p. 59, 1864.

Under the name of *P. favosa*, Prof. Dana included specimens both from the Feejees and Hawaiian Islands. A careful examination of his original specimens, and comparisons with large series more recently collected, have convinced me that the specimens from these two localities really belong to distinct species, both of which appear to differ from the typical specimens described by Ehrenberg from the Red Sea. The Feejee species may be distinguished by the following characters.

Branches moderately stout, variable both in size and length, quite irregular, the ends usually enlarged, often compressed and lobed, the summits very cellular, usually with subobsolete verrucæ, but the younger branches often terminated by prominent ones. Sides of the branches with rather large, prominent, obtuse, irregularly scattered verrucæ, which rise obliquely and are scarcely appressed. Cœnenchyma compact, with very fine spinule-like grains evenly scattered over the surface. Lateral cells between the verrucæ rather small, circular, with the septa and columella scarcely distinct, though in some cells near the base twelve very narrow septa are visible. Texture rather firm.

Feejee Islands. J. D. Dana. U. S. Expl. Expedition.

POCILLIPORA ASPERA Verrill, sp. nov.

Pocillopora favosa (pars) Dana, loc. cit. (non Ehrenberg).

Pocillopora plicata (pars) Dana, op. cit., p. 534.

Corallum branching much as in the preceding, forming dense hemispherical clumps, often more than a foot in diameter; often having a rather rough and ragged appearance, owing to irregularity of the branches and prominence of the verrucæ. Branches very variable in different examples, and often even in the same specimen; sometimes quite slender and not more than half an inch in breadth and varying in length from one to four inches, strongly compressed at the ends, or even tapering; more commonly much and irregularly subdivided, the ends enlarged and variously lobed, and often conspicuously verrucose at summit; sometimes the branches are stouter, less subdivided, compressed, one to two inches in breadth, three to six thick and three to five long, some with the ends verrucose, others scarcely so. The lateral verrucæ are generally distant, irregular, often elongated, rising very obliquely, or more or less appressed to the surface; in other cases small, but little prominent, or even subobsolete, especially below. Cells large, those at the summit much crowded, deep, separated by thin walls; the lateral ones mostly circular, not distant, usually with a prominent columella and twelve distinct septa, one of which is wider and joins the columella. Cœnenchyma between the lateral cells not very abundant, the surface thickly covered with very rough, coarse, spinulose grains.

The largest specimens are more than a foot in diameter.

Hawaiian Islands. Horace Mann; W. T. Brigham; J. D. Dana.

VAR. LATA Verrill.

Pocillopora plicata (pars) Dana, loc. cit.

One specimen (referred to *P. plicata* by Dana) has the branches stouter, .3 to .5 of an inch thick, and one to three inches or more broad, variously plicate, with the summits lobed and mostly naked, the smaller ones often verrucose, but in the characters of the lateral verrucæ and cells it scarcely differs from the large specimens of the ordinary variety. The lateral cells, however, generally have the septa less developed, and the surface between

them is not so strongly spinulose. But some of the outer branches have the stellate cells and rough surface of the ordinary form. The lateral verrucæ are rather distant, not very prominent, very oblique and somewhat appressed to the surface. The naked ends of the branches are covered with large, crowded, deep cells, separated by thin walls. The summits of the branches are separated by quite regular intervals, .3 to .4 of an inch broad. The specimen is about twelve inches broad and six high.

Hawaiian Islands. Rev. Mr. Baldwin, Museum of Yale College.

POCILLIPORA LIGULATA Dana.

Zoöphytes, p. 531, pl. 50, fig. 2, 2a; Edw. and Haime, Corall., III, p. 306.

The two original specimens, described by Prof. Dana, are in the Museum of Yale College.

In mode of branching and form of the verrucæ, they resemble some forms of *P. aspera*, though the branches are more regular and unusually divergent and distant. The longer branches are much compressed, thin and mostly dilated at the ends, .4 of an inch to 1.5 broad, and .3 to .4 thick. The larger branches have very cellular, naked summits; some of the younger branches are strongly verrucose at the end. The lateral verrucæ are well developed, not crowded, ascending, and mostly partially appressed to the surface. The lateral cells are rather distant, quite small, neatly stellate with twelve well-developed septa, one of which joins the small, prominent columella. The cœnenchyma is firm, between the cells covered with small, spinulæ-like grains. The specimens are about six inches high and broad.

Hawaiian Islands. Rev. Mr. Baldwin.

This species is evidently closely allied to *P. aspera*, from which it differs chiefly in its smaller and more distant cells, more fully developed septa, and the finer granulation of the cœnenchyma. With a larger series of specimens it might, perhaps, be possible to unite the two, but as yet I have observed no intermediate forms.

POCILLIPORA PLICATA Dana.

Pocillopora plicata (pars) Dana, Zoöph., p. 534, pl. 50, fig. 7, 7a to 7d.

A comparison of the original specimens shows that the typical form from the Feejees is quite different from the Hawaiian specimen described above (*P. aspera*, var. *lata*), although so similar in its branches and mode of growth that, without a direct comparison, especially of the cells, they would naturally be confounded, as was done by Prof. Dana. In this species the coral is very porous, and the cells are but little filled up below by solid matter, so that the transverse plates are often distinct through the whole length. The lateral cells are well separated, circular, rather large, stellate, having twelve unusually well developed septa and a small columella. The coenenchyma between the cells is evenly covered with small spinules, much less rough than in *P. aspera*. The verrucæ are also more appressed and less numerous.

Feejee Islands. J. D. Dana. U. S. Expl. Expedition.

This species may best be distinguished from *P. aspera*, var. *lata* by the more distant cells, more highly developed septa, the finer and more even granulation of the surface, and the more porous texture.

POCILLIPORA FRONDOSA Verrill, sp. nov.

Corallum light and unusually porous, forming hemispherical clumps, consisting of numerous elongated, irregular, often crooked, compressed, frond-like branches, with expanded and variously lobed and plicate ends. The branches are from .3 of an inch to 1.5 broad, and .3 to .5 thick, except at the summits, which are scarcely .25. The verrucæ are nearly obsolete, both upon the sides and ends of the branches, being represented upon the lateral surfaces only by distant and slightly elevated, irregular prominences and low ridges, which are often wholly wanting. Cells large and deep, rather crowded, the spaces between seldom equal to half their diameter even

low down on the sides of the branches. Septa twelve, quite distinct, though narrow, one of them joining the columella, which is usually distinct, but low down in the cell; surface of cœnenchyma rough, thickly covered with rather coarse spinules.

Hawaiian Islands. W. T. Brigham.

This species is nearly allied to *P. aspera* by the structure of the cells and surface of the cœnenchyma, but is remarkable for its peculiar frond-like branches, destitute of distinct verrucæ. It is possible, however, that it may eventually prove to be only an extreme variety of that species. *P. informis* Dana differs in its irregular mode of growth and in the absence or rudimentary condition of the septa.

POCILLIPORA NOBILIS Verrill.

Pocillopora verrucosa (*pars*) Dana, Zoöph., p. 529. Plate 50, fig. 3, 3a, 1846 (*non* Lamarck; Edw. and Haime).

Pocillopora nobilis Verrill, Bulletin Mus. Comp. Zoölogy, p. 59, 1864.

Corallum firm and dense, forming large round-topped or hemispherical clumps, often a foot or even eighteen inches in diameter. Branches nearly equal in length, separated by regular intervals of .4 to .5 of an inch, elongated, often nearly round, .6 to .75 of an inch in diameter, regularly forking and not enlarged at the obtusely rounded ends; in other cases, even in the same specimen, dilated at the ends to a breadth of two or three inches and more or less plicated. Summits of the branches generally strongly verrucose, the verrucæ similar to those of the sides, but usually smaller and more crowded. Lateral verrucæ very numerous, rather crowded, the intervals being usually less than their diameter, small, regular, spreading obliquely, or even standing at right angles to the surface, tapering and somewhat rounded at the end, but angular and containing but few, quite large cells. Between the verrucæ the cells are rather large, numerous, usually less than half their own diameter apart. Septa but little developed, very narrow, usually indistinct, or wholly obsolete. Columella very small or wanting. Surface of the cœnenchyma regularly

covered with rather small spinuliform granules. Color of the unbleached coral deep yellowish brown.

Hawaiian Islands. J. D. Dana; Rev. Mr. Baldwin; A. Garret; Horace Mann; W. T. Brigham.

Var. TUBEROSA.

One specimen, which I refer with doubt to *P. nobilis*, is peculiar in having much larger and more prominent lateral verrucæ, which are rounded and often swollen at the end, or even obovate. Towards the base the verrucæ are less prominent and even hemispherical. The ends of the branches are enlarged, often lobed, and thickly covered with prominent verrucæ. The lateral cells are of medium size, not crowded, with the septa and columella but little developed. Surface between the cells closely granulous.

Hawaiian Islands. W. T. Brigham.

A species closely allied to *P. nobilis* occurs at Zanzibar, of which there is but one broken specimen in the Museum of Yale College. Its mode of growth and form of branches and verrucæ are the same, but it has smaller and less crowded cells, and the surface is much less granulous, with finer grains. The septa and columella are little developed, except in some of the cells near the base, where they become more distinct.

POCILLIPORA MÆANDRINA Dana.

Zoöph., p. 533, Plate 50, fig. 6, 6a, 6b, 1846.

The original specimen of this species is in the Museum of Yale College. It is closely allied to *P. nobilis*, but has mostly broad, plicated and convoluted, short, frond-like branches, with nearly naked summits. The verrucæ are rather small and closely crowded. The cells are somewhat smaller than is usual in *P. nobilis*, and the septa are in general very narrow, or scarcely apparent. The surface is finely granulous. Its resemblance to *P. nobilis* is so great as to suggest the possibility that it may be only an extreme variety of that species.

Hawaiian Islands. Rev. Mr. Baldwin.

POCILLIPORA ELONGATA Dana.

Zoöphytes, p. 531, Plate 59, fig. 4, 4b, 1846.

The original specimen of this fine species is also in the Museum of Yale College. It consists of very long, stout, furcate, rounded branches, about an inch in diameter, and often six inches or more long. The ends are obtuse, generally not much dilated, the longer ones without terminal verrucæ, the shorter ones with prominent ones. The lateral verrucæ are quite regularly scattered throughout, usually at distances greater than their diameter, prominent sub-conical, rounded, often standing nearly at right angles to the surface. The cells are neatly stellate, not large, well separated below, towards the ends of the branches becoming polygonal, separated often by a slight sulcus and a single row of spinules, and appearing sunken below the surface. The twelve septa are well developed, the six primaries often wider and thicker than the secondaries. The spaces between the septa are usually somewhat filled up and the edge of the cells is enlarged or excavate, giving them a sunken appearance. The collumella is small, but prominent and acute, often wanting. Surface of the cœenchyma rough, with rather large, sharp, conical, spinule-like granules, which are evenly scattered, not crowded. Texture rather porous, the cells but little filled up below, and often show the transverse plates throughout. The whole height of the coral is about fifteen inches.

Ceylon. Rev. G. A. Apthorp.

POCILLIPORA CAPITATA Verrill.

Bulletin Mus. Comp. Zoölogy, p. 60, 1864.

Socorro Isles; Acapulco; La Paz; Pearl Islands, Panama Bay.

Var. POROSA, nov.

Corallum forming large rounded clumps, twelve to fifteen inches in diameter, with more or less elongated, sub-parallel, angular branches, which are from .25 to .75 of

an inch in diameter, and one to three long, often flattened and truncate at the end. Verrucæ large and prominent, ascending, the upper ones appressed, wholly obsolete on the ends of the larger branches. Lateral cells crowded, large and deep, with twelve to twenty-four distinct, but narrow and nearly equal septa, which are a little exsert and acute at summit. Cœnenchyma between the cells not abundant, often thin, the surface finely spinulose. Cells but little filled up below by solid deposits.

Near La Paz, Gulf of California. J. Pedersen.

POCILLIPORA LACERA Verrill, sp. nov.

Corallum forming irregular rounded clumps, six to eight inches in diameter and height, consisting of variously and irregularly divided, crooked branches, usually digitately lobed, or lacerately divided, at the ends. Branchlets short, irregular, often like elongated verrucæ. On the larger branches the verrucæ are small, irregular, and distant. Cells rather large, rounded, not crowded; sometimes with twelve to twenty-four very narrow septa, which are often abortive. Columella rudimentary or wanting. Cœnenchyma abundant, firm, the surface finely and evenly spinulose.

Acajutla and Pearl Islands. F. H. Bradley.

SERIATOPORA sp.

A species allied to *S. subulata*, represented only by a fragment. The branches are slender, coalescent and reticulated. The cells are small and in series; borders scarcely prominent.

Groper Shoal, Coral Sea. Dr. Wm. Stimpson.

Note on Gorgonidæ. — Having recently had an opportunity to study a large series of spicula, many of them prepared from authentic and original specimens in various European Museums, and sent by Dr. Kölliker, I have found it necessary to change the names of several genera and species (see Amer. Journal Science, Nov., 1869, p. 419). The names of species described in this Synopsis, which have been changed, stand as follows: —

Eunicella venosa Verrill = *Gorgonia venosa* Val.

E. palma Verrill = *G. albicans* Köll.

Leptogorgia flammea V. = *Lophogorgia palma* E. and H. (non Pallas).

Leptogorgia cuspidata V. = *Litigorgia cuspidata* V.

GEOGRAPHICAL LISTS

OF THE

SPECIES ENUMERATED IN THIS SYNOPSIS.

MADEIRA.

<i>Eunicella venosa</i> V.	<i>Comactis flagellifera</i> E. & H.
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CAPE OF GOOD HOPE.

<i>Euplexaura Capensis</i> V.	<i>Halocampa Stimpsonii</i> V.
<i>Leptogorgia flammea</i> V.	<i>Halocampa Capensis</i> V.
<i>Eunicella palma</i> V.	<i>Cereus Stimpsonii</i> V.
<i>Eunephthya thyrsoides</i> V. (False Bay).	<i>Corynactis annulata</i> V. (False Bay).
<i>Balanophyllia Capensis</i> V. (Simon's Bay).	

PORT JACKSON, AUSTRALIA.

<i>Plesiastrea Urvillei</i> E. and H.	<i>Metridium</i> , sp.
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CORAL SEA.

<i>Madrepora globiceps</i> (?) Dana. (Groper Shoal).	<i>Turbinaria</i> , sp.
	<i>Seriatopora</i> , sp.

TAHITI.

<i>Madrepora hebes</i> Dana. (Loo Choo?).	<i>Madrepora tubicinaria</i> Dana.
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FEEJES.

<i>Pocillipora Danæ</i> V.	<i>Fungia lacera</i> V.
<i>Pocillipora plicata</i> Dana.	<i>Pachyseris monticulosa</i> V.

EBON ISLAND.

<i>Paracyathus Ebonensis</i> Verrill.	
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HAWAIIAN ISLANDS.

<i>Montipora patula</i> V.	<i>P. informis</i> Dana.
<i>Cœnopsammia Mannii</i> V.	<i>P. mœandrina</i> Dana.
<i>Pocillipora cœspitosa</i> Dana.	(?) <i>Cœlastræa tenuis</i> V.
<i>P. aspera</i> V. and <i>var. lata</i> V.	(?) <i>Astræa Hombronii</i> V.
<i>P. ligulata</i> Dana.	(?) <i>Astræa rudis</i> V.
<i>P. frondosa</i> V.	<i>Leptastræa stellulata</i> V.
<i>P. nobilis</i> V. and <i>var. tuberosa</i> V.	<i>Cyphastræa ocellina</i> E. and H.

LOO CHOO ISLANDS.

<i>Spongodes gracilis</i> V.	<i>Plesiastrea indurata</i> V.
<i>Telesto</i> (?) <i>nodosa</i> V.	<i>Galaxea fascicularis</i> (?) Oken.
<i>Madrepora turgida</i> V.	<i>Fungia papillosa</i> V.
<i>Madrepora micropthalma</i> V.	<i>Pavonia complanata</i> V.
<i>Montipora poritiformis</i> V.	<i>Stephanoseris lamellosa</i> V.
<i>Montipora lichenoides</i> V.	<i>Zoanthus</i> , sp.
(?) <i>Porites tenuis</i> V.	<i>Zoanthus</i> , sp.
<i>Psammocora parvistella</i> V.	<i>Palythoa</i> , sp.
<i>Dendrophyllia Cecilliana</i> E. and H.	<i>Sagartia</i> (?) <i>Napensis</i> V.
<i>Pocillipora gracilis</i> V.	

BONIN ISLANDS.

<i>Tubipora rubeola</i> (?) Q. and G.	<i>Phellia</i> (<i>Paraphellia</i>) <i>inequalis</i> V.
<i>Madrepora pumila</i> V.	<i>Phellia</i> , sp.
<i>Montipora rigida</i> V.	<i>Sagartia</i> , sp.
<i>Euphyllia undulata</i> V.	<i>Amphiactis orientalis</i> V.
<i>Cerianthus Stimpsonii</i> V.	<i>Discostoma fungiforme</i> V.
<i>Paranthea minuta</i> V.	

OUSIMA.

<i>Madrepora teres</i> V.	<i>Diaseris pulchella</i> V.
<i>Madrepora prolixa</i> V.	<i>Phellia clavata</i> V.
(?) <i>Madrepora striata</i> V. (Loo Choo?).	<i>Phellia</i> , sp.
(?) <i>Pavonia foliosa</i> V. (Loo Choo?).	<i>Cereus</i> , sp.
	<i>Sagartia nigropunctata</i> V.

EAST INDIES AND CEYLON.

<i>Madrepora nobilis</i> Dana. (Gaspar Straits).	<i>Pocillipora brevicornis</i> Lam. (Ceylon).
<i>Montipora exesa</i> V. (Gaspar Str.).	<i>Heterocyathus alternata</i> V. (Gaspar Straits).
<i>Montipora foliosa</i> E. and H. (Ceylon?).	<i>Stephanoseris sulcata</i> V. (Ceylon).
<i>Pocillipora elongata</i> Dana. (Ceylon).	<i>Stephanactis Indica</i> V. (Gaspar Straits).

HONG KONG AND CHINA SEA.

<i>Pteromorpha expansa</i> V.	<i>Spongodes gigantea</i> V.
<i>Virgularia pusilla</i> V.	<i>Spongodes capitata</i> V.
<i>Veretillum Stimpsonii</i> V. (H. K. and China Sea).	<i>Anthella lineata</i> St.
<i>Kophobelemnion clavatum</i> V.	<i>Telesto ramiculosa</i> V.
<i>Muricea flexuosa</i> V.	<i>Sarcodictyon</i> , sp.
<i>Astrogorgia Sinensis</i> V.	<i>Madrepora tumida</i> V.
<i>Anthogorgia divaricata</i> V.	<i>Porites</i> , sp.
<i>Echinomuricea coccinea</i> V.	<i>Turbinaria Sinensis</i> V.
<i>Juncella levis</i> V.	<i>Dendrophyllia gracilis</i> E. and H.
<i>Parisis laxa</i> V. (H. K. and Formosa).	<i>Pachypsammia valida</i> V.
<i>Alcyonium?</i>	<i>Goniastrea aspera</i> V.
<i>Nephtya aurantiaca</i> V. (23° N. Lat.).	<i>Cœloria Sinensis</i> E. and H.
	<i>Astræa ordinata</i> V.
	<i>Prionastrea Chinensis</i> V.
	<i>Paracyathus porcellana</i> V.

<i>Cerianthus orientalis</i> V.	<i>Sagartia Paguri</i> V. (28° N. Lat.).
<i>Halocampa brevicornis</i> V.	<i>Sagartia lineata</i> V.
<i>Actinia?</i> <i>timida</i> V.	<i>Cancrisocia expansa</i> Stimpson.
<i>Paranthea armata</i> V.	<i>Bunodes inornata</i> V.
<i>Ammonactis rubricollum</i> V.	<i>Physactis multicolor</i> V.
<i>Phellia collaris</i> V.	<i>Anthopleura Stimpsonii</i> V.
<i>Cereus Sinensis</i> V.	<i>Homactis rupicola</i> V.

JAPAN AND NORTH CHINA SEA.

<i>Mopsella Japonica</i> V.	<i>Stephanoseris Japonica</i> V. (Kag. Bay).
<i>Sarcophytum agaricum</i> V. (Kag. Bay).	<i>Edwardsia cretata</i> V. (Kag. Bay).
<i>Madrepora arbuscula?</i> Dana. (Kag. Bay).	<i>Sagartia radiata</i> V. (Kag. Bay).
<i>Eupsammia Stimpsoniana</i> V. (25 fathoms).	<i>Bunodes Japonica</i> V. (Hak. Bay).
<i>Ctenactis</i> , sp. (young).	<i>Urticina cocclinea</i> V. (Kag. Bay).
	<i>Anthopleura</i> , sp. (Simoda).

OCHOTSK SEA.

<i>Veretillum baculatum</i> V. (25 fathoms).	<i>Alcyonium?</i> (<i>Lobularia Verrilli</i> Gray).
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BEHRING'S STRAITS AND ARCTIC AMERICA.

<i>Primnoa compressa</i> V. (Aleut. I.).	<i>Phellia arctica</i> V. (Arctic Ocean).
<i>Alcyonium rubiforme</i> Dana.	<i>Urticina crassicornis</i> Ehr.

PUGET SOUND AND CALIFORNIA.

<i>Ptilosarcus Gurneyi</i> Gray. (Puget Sound).	<i>Metridium fimbriatum</i> V. (Pag. Sd. and San Francisco).
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PANAMA, LOWER CALIFORNIA AND GULF.

<i>Leioptilum undulatum</i> V. (Gulf).	<i>Pocillipora capitata</i> V.
<i>Leptogorgia cuspidata</i> V. (Cape St. Lucas).	var. <i>porosa</i> V.
<i>Allopora Californica</i> V.	<i>P. lacera</i> V. (Panama).

WEST INDIES.

<i>Phellia Vernonia</i> V.	<i>Phellia cricoides</i> V.
<i>Phellia Americana</i> V.	<i>Phellia Coreopsis</i> V.

UNKNOWN.

<i>Turbinaria dichotoma</i> V. (Bonin or Loo Choo?).	<i>Flabellum</i> , sp.
	<i>Fungia</i> , sp.

EXPLANATION OF PLATES.

PLATE 1.

Figure 1. *EDWARDSIA CRETATA* Stimpson, much enlarged; 1 *a*, one of the tentacles, showing arrangement of color-bands.

Figure 2. *PHELLIA COLLARIS* Verrill, natural size; 2 *a*, one of the tentacles enlarged.

Figure 3. *PHELLIA CLAVATA* Verrill, natural size; 3 *a*, one of the inner tentacles enlarged; 3 *b*, one of the outer tentacles, showing the arrangement of colors.

Figure 4. *PHYSACTIS MULTICOLOR* Verrill, natural size; 4 *c*, profile view of mouth and two of the tentacles.

Figure 5. *BUNODES INORNATA* Verrill, view of the disk from above; 4 *a*, one of the outer tentacles; 4 *b*, one of the inner ones.

Figure 6. *URTICINA COCCINEA* Verrill, natural size.

Figure 7. *DISCOSTOMA FUNGIFORME* Verrill, natural size.

PLATE 2.

Figure 1. *CANCRISOCIA EXPANSA* Stimpson, natural size in its normal position on the carapax of *Dortippe*; 1 *a*, enlarged view of the mouth and part of the disk and tentacles, as seen from above.

Figure 2. *SAGARTIA NIGROPUNCTATA* Verrill, natural size; 2 *a*, view of the disk and tentacles from above, natural size; *a*, the long, odd tentacle in the plane of the longer axis of the mouth; 2 *b*, one of the shorter tentacles, enlarged; 2 *c*, one of the longer inner tentacles.

Figure 3. *CEREUS SINENSIS* Verrill, natural size.

Figure 4. *SAGARTIA* (?) *NAPENSIS*, Verrill, natural size; 4 *a*, a tentacle much enlarged.

V. Flora of the Hawaiian Islands.

BY HORACE MANN.

[Concluded from vol. v, p. 248.]

1. PAPAYA Tourn. [*Milikana* Hei.]

Genus (which, with another, forms the small tribe of *Papayaceæ*) with unisexual flowers, differing from the rest of the order in that the flowers are destitute of a crown, the stamens distinct and in 2 series, inserted on the throat of the corolla; the ovary sometimes spuriously 5-celled; and the species being small trees with milky juice. Male flowers: Calyx small, 5-toothed. Corolla hypogynous, funnel-shaped, limb 5-lobed. The 5 stamens opposite the corolla lobes sessile, the 5 alternate ones with short filaments. Female flowers: Calyx as in the male. Petals 5, linear-oblong, erect, deciduous. Style very short; stigma dilated radiately 5-lobed or simple. Fruit baccate, 1-celled, with a firm rind, pulpy inside.—Soft-wooded trees, with palmately many-lobed or rarely entire leaves, in terminal clusters. Peduncles axillary, the male one many-flowered, racemed or corymbed, the female ones few-flowered.

A small tropical American genus.

1. PAPAYA VULGARIS, *D C. (Enum. No. 147.)* A small tree, usually with a simple erect trunk, but sometimes branching; the trunk becoming hollow with age and containing a large quantity of fluid. Leaves clustered at the summit of the trunk or branches, petioled, 1° more or less, in diameter, palmately many-lobed. Flowers white or whitish. Fruit large, orange-yellow, edible.

Much planted and now run wild in many places. Commonly called *Papaya*, *Pawpaw* or *Papaw*. Native of tropical America, but common now in most tropical countries.

ORDER XXXV. CUCURBITACÆ.

Tender or succulent herbs, climbing by tendrils; with alternate, palmately veined, or lobed, rough leaves, and monœcious (in all our species) or diœcious flowers. Calyx of 4 or 5 (rarely 6) sepals, united into a tube, and in the fertile flowers adherent to the ovary. Petals as many as sepals, commonly more or less united into a monopetalous corolla, which coheres with the calyx. Stamens 5 or 3, or rather two and a half, *i. e.* two with 2-celled anthers, and one with a 1-celled anther, inserted into the base of the corolla or calyx, either distinct or

variously united by their filaments, and long, sinuous or contorted anthers. Ovary 1-5-celled; the thick and fleshy placentæ often filling the cells, or diverging before or after reaching the axis, and carried back so as to reach the walls of the pericarp, sometimes manifestly parietal; the dissepiments often disappearing during its growth, sometimes only one-ovuled from the top; stigmas thick, dilated or fringed. Fruit (pepo) usually fleshy, with a hard rind, sometimes membranous. Seeds mostly flat, with no albumen. Embryo straight; cotyledons foliaceous.

The species *Cucurbita pepo*, the Pumpkin, Winter-squash, &c.; *C. maxima*, the squash; *Citrullus vulgaris*, the Watermelon; *Cucumis melo*, the Musk-melon; and *C. sativus*, the Cucumber, are much cultivated for their edible fruits.

1. LAGENARIA Ser. [Ipu.]

Flowers solitary. Male flowers long peduncled. Calyx-tube campanulate or funnel-shaped, with 5 lanceolate or subulate, spreading lobes. Petals 5, free, spreading, obcordate or obovate, retuse, mucronate. Stamens inserted on the calyx-tube, the filaments free; anthers slightly cohering, the cells tortuous. Ovary wanting. Female flowers short peduncled. Calyx and corolla as in the male. Stamens, none. Ovary oblong, ovoid, or cylindrical, with 3 placentæ; style short, thick, with 3 two-lobed stigmas; ovules indefinite, horizontal. Fruit of various shapes, woody, indehiscent, with a soggy meat. Seeds compressed, margined.—Climbing or trailing pubescent herbs, with ovate- or reniform-cordate, or nearly orbicular, large, dentate leaves, the petioles with two glands near the apex. Tendrils bifid. Flowers large, white.

Species 1, native of tropical Asia and Africa, cultivated throughout the tropics.

1. LAGENARIA VULGARIS Ser. (Enum. No. 140.)

2. CUCURBITA Linn. [Ipu.]

Flowers solitary. Male flowers: Calyx-tube campanulate, 5-lobed. Corolla campanulate, 5-cleft. Stamens 3, inserted on the base of the calyx; filaments free; anthers linear, compacted in a head, the elongated cells flexuose. Ovary wanting. Female flowers: Calyx and corolla as in the male. Rudiments of stamens 3. Ovary oblong, with 3 placentæ; style short, with 3 two-lobed or two cleft stigmas; ovules numerous, horizontal. Fruit fleshy, usually with a rind, indehiscent. Seeds ovate or oblong, flat.—Herbs with annual or perennial roots, cordate and lobed large leaves, 2-many-cleft tendrils, and large yellow flowers. The fruit often gigantic.

A small genus, native of tropical regions.

1. C. MAXIMA Duch. (Enum. No. 141.) Stems long, spreading, or

climbing by means of tendrils. Leaves cordate, roughened, or hispid petioles. Calyx-tube obovate, constricted in the throat. Fruit globose, large, yellow or greenish or reddish.

Cultivated from time immemorial by the natives; probably introduced. Native country impossible to designate, as this species has been cultivated by man in most all tropical regions for so long a time.

3. *SICYOS* Linn. [Palunu.]

Male flowers racemed or corymbed. Calyx-tube very broadly campanulate, with 5 small teeth, or entire. Corolla rotate, 5-parted, the segments triangular-ovate and whole confluent with the calyx. Stamens confluent by the base of their filaments in a short column; anthers 2-5, sessile at the apex of the column, connate in a head or more or less free, the cell curved or very flexuose. Ovary wanting. Female flowers usually in the same raceme as the male, at the apex of a more or less elongated peduncle, rarely solitary. Calyx above the ovary and corolla as in the male. Stamens none. Ovary ovate or subulate, sometimes long-beaked, setose or aculeate, or rarely smooth, 1-celled; style short, with 3 stigmas; ovule one, hanging from the apex of the cell. Fruit leathery or somewhat woody, angled. Seed with a membranaceous testa. — Glabrous or pubescent-scabrous, climbing or prostrate herbs, with angled, lobed, or cleft membranous leaves; 3-cleft tendrils, minute flowers, and small fruit. — The Hawaiian species belong to the section or

Subgenus *SICYOCARYA*. Fruit ovate-pyramidal or oblong, 4-6 (rarely 3-) angled, unarmed, and more or less beaked; the pericarp much thickened. Anthers 2-5, contorted and adnate at their bases; the connective narrow.

A small genus, mostly found in the hot parts of America, the subgenus peculiar to the Hawaiian Islands.

Leaves nearly or quite glabrous, large; fruit more than 3 lines long.

Leaves lobed, cordate at the base. Male flowers 1 or 2 lines in diameter. *S. pachycarpus*.

Leaves barely lobed. Male panicles umbellate or a long peduncle; flowers 5 lines in diameter when expanded. *S. macrophyllus*.

Leaves barely or very deeply lobed. Male panicles long peduncled, 3-branched; flowers 3 or more lines in diameter. *S. cucurbitinus*.

Leaves hispid or papillose scabrous, especially beneath, small. Flowers very small, as are the fruits which are 2 lines long. *S. microcarpus*.

1. *S. (SICYOCARYA) PACHYCARPUS* Hook and Arn. (*Enum. No. 142.*)

Stems slender, angled, nearly glabrous, sometimes with glandular-tipped hairs. Leaves membranaceous, 3'-5' in diameter, rounded and cordate-angled, 3-7-lobed, the terminal lobe the longest; the margin of the leaf remotely denticulate, the lower surface somewhat papillose-scabrous; petioles 1'-2' long. Male flowers small, a line or two in diameter, in racemose, simple or compoundly branched panicles. Female flowers numerous in a small head at the summit of the pedun-

cle. Fruit ovate-pyramidal, several usually ripening in the head, closely sessile, 5''-7'' long, 5-6-angled, pointed with a slender beak.

Kaala mountains and district of Waianae, Oahu, mountains of West Maui.

2. *S. (SICYOCARYA) MACROPHYLLUS Gray. (Enum. No. 143.)* Stem strongly angled, pubescent or quite glabrous. Leaves rounded-cordate, slightly or more deeply 3-5-lobed, often large, 3'-10' in diameter, membranaceous, glabrous or softly puberulent underneath, not scabrous, the margin sharply toothed with short callous-tipped teeth; petioles 3' long. Male panicles umbellate at the summit of a long and slender peduncle (5'-7' long) glandular-puberulent as are the flower buds, on pedicels 4''-5'' long, which are often fascicled. The perianth becoming 5'' in diameter when expanded. Female flowers clustered at the summit of a short peduncle. Fruit ovate, 5-6-angled, nearly glabrous, conspicuously beaked.

Forests of Mauna Kea, Hawaii.

3. *S. (SICYOCARYA) CUCUMERINUS Gray. (Enum. No. 144.)* Stem strongly angled, glabrous. Leaves broadly cordate, or sometimes almost kidney-shaped, undivided and scarcely lobed $3\frac{1}{2}'$ -6 $\frac{1}{2}'$ in diameter, glabrous, membranaceous, the margin sharply denticulate. Male flowers in a three-branched racemose panicle on a short or long (2'-4') peduncle, the perianth 5-cleft to the middle, about 4'' broad when expanded. Female flowers on the summit of a shorter peduncle; the ripe ovaries a few together at the summit of the peduncle, sessile, oblong, an inch long, 5-6-angled but not sharply so, and with a long beak which often breaks off. One *variety* presents leaves which are slightly lobed, and another *variety* leaves which are palmately 3-lobed, nearly to the base, the lobes being again more or less lobed, and all sharply toothed, and sometimes scabrous.

Hawaii, in forests on Mauna Kea; the *varieties* also from the mountains above Waimea, Kauai.

4. *S. (SICYOCARYA) MICROCARPUS H. Mann. (Enum. No. 165.)* Stem strongly angled, glabrous. Leaves papillose-scabrous above, hispid below, on slender petioles of more than their own length, 1'-2 $\frac{1}{2}'$ in diameter, angled, deeply cordate at the base, thin membranaceous. Male panicles three-branched, on slender peduncles exceeding the leaves in length, flowers very small. Female flowers 30-40 in a head on a peduncle only 3'' or 4'' long; the fruits 2'' long, sessile, and crowded, several angled by mutual pressure, short-beaked.

Oahu.

ORDER XXXVI. BEGONIACEÆ.

Succulent herbs or under shrubs, with scattered or two-ranked, or rarely somewhat verticillate entire, lobed, or digitately-parted, inæqui-

lateral leaves, with 2 free, usually caducous stipules, and axillary, peduncled, bracted cymes, bearing one or both sexes of flowers. Flowers monœcious, asymmetrical, white, red or yellow, and very showy. Male flowers: Perianth segments 2 or more, the exterior usually 2, sepaloid, opposite, valvate, the interior petaloid, imbricated, or none. Stamens indefinite; filaments free or connate. Ovary wanting. Female flowers: Perianth segments 2-5, rarely more, variously disposed. Ovary more or less inferior, 1-many-celled, but usually 3-celled and 3-angled. Styles 2-5, more or less joined, usually 2-cleft. Ovules very numerous. Fruit capsular or berry-like. Seeds minute, with thin or no albumen.

Many species of *Begonia*,—in which the male flowers have the 2 outer perianth-leaves sepaloid, the 2 inner petaloid, or rarely more than 2 or wanting, the stamens indefinite, free or monadelphous; female flowers with usually 6 leaves to the perianth, of which the 2 outer larger ones are sepaloid, a usually 3-celled inferior ovary, with as many 2-many-cleft styles; the placenta usually in the axis of ovary; fruit usually capsular, and septically or loculicidally dehiscent,—are cultivated for their showy flowers and bracts.

1. HILLEBRANDIA Oliver.

Male flowers: Sepals 5, nearly equal, broadly ovate, acute. Petals 5, alternate with the sepals, small, spathulate, and hooded. Stamens indefinite, free. Female flowers: Calyx tube hemispherical, wingless, adnate to the ovary, with a 5-lobed limb. Petals as in male flowers. Stamens represented by numerous minute stipitate perigynous glands. Ovary open at the free apex, imperfectly 5-celled, with five bilamellar placenta, projecting into the cells; styles 5, opposite the calyx-lobes, 2-cleft. Capsule membranaceous, wingless, dehiscing by a broad opening at the top between the styles. — A branched, hairy, succulent herb, with oblique-cordate-rotund irregularly 5-9-lobed sharply serrate petioled leaves, and many bracted, peduncled cymes, bearing both sexes of flowers.

Genus of one species, peculiar to the Hawaiian Islands.

1. HILLEBRANDIA SANDWICENSIS Oliver. (*Enum. No. 147.*) A large herb 3°-6° high.

Valleys behind Lahaina, West Maui, where it was first discovered by Mr. Dwight Baldwin. Waiohi Valley Kauai. Mountain above Waimea, Kauai, often on cliffs by the side of cascades or on the moist banks of brooks high in the mountains.

ORDER XXXVII. UMBELLIFERÆ.

Herbs, with hollow stems, and alternate, dissected leaves, with the petioles sheathing or dilated at the base. Flowers in simple or mostly compound umbels, which are occasionally contracted into a kind of head. Calyx entirely coherent with the surface of the dicarpellary

ovary; its limb reduced to a mere border, or to 5 small teeth. Petals 5, valvate in æstivation, inserted, with the 5 stamens, on a disk which crowns the ovary; their points inflexed. Styles 2; their bases often united and thickened, forming a stylopodium. Fruit dry, a *cremocarp*, consisting of 2 united carpels, at maturity separable from each other, and often from a slender axis (*carpopphore*), into two achenia, or *mericarps*: the face by which these cohere is called the *commissure*: they are marked with a definite number of *ribs* (*juga*), which are sometimes produced into wings: the intervening spaces (intervals), as well as the *commissure*, sometimes contain canals or receptacles of volatile oil, called *vittæ*. Embryo minute, in hard or corneous albumen.

Aquatic herb, with peltate or shield-shaped leaves, 1. HYDROCOTYLE.
Land herbs.

Bristles of the fruit hooked; leaves palmately-lobed or parted, 2. SANICULA.

Bristles of the fruit barbed; leaves twice pinnate, 4. DAUCUS.

Fruit not bristly, 3. FENICULUM.

1. HYDROCOTYLE Tourn. [Poe, Pohi.]

Calyx-teeth obsolete: Fruit flattened laterally, orbicular or shield-shaped, the carpels 5-ribbed, two of the ribs enlarged and often forming a thickened margin: oil tubes none.—Low and smooth marsh perennials, with slender stems creeping or rooting in the mud, and round shield-shaped or kidney-form leaves. Flowers small, white, in simple umbels or clusters, which are either single or proliferous.

A considerable genus, dispersed over the greater part of the globe.

1. H. INTERRUPTA *Muhl.* (*Enum. No. 149.*) Leaves peltate in the middle, orbicular crenate; peduncles about the length of the leaves, bearing clusters of few and sessile flowers interruptedly along its length; fruit broader than long, notched at the base.

In marshy and wet places; frequent near two ponds. Also native of North America.

2. SANICULA.

Calyx teeth manifest, persistent. Fruit globular; the carpels not separating spontaneously, ribless, thickly clothed with hooked prickles, each with 5 oil-tubes.—Perennial herbs, with palmately-lobed or parted leaves, those from the root long petioled. Umbels irregular or compound, the flowers capitate in the umbellets, perfect, and with staminate ones intermixed. Involucre and involuclers few-leaved.

A small genus, mostly found in North Temperate regions.

1. S. SANDWICENSIS *Gray.* (*Enum. No. 150.*) Root fusiform, 6'-10' long. Stem 1°-2° high, angular glabrous, as is the whole plant. Leaves roundish, 2' in diameter, palmately 3-5-parted or almost

divided; the cuneate segments 2-3-cleft and incised, sometimes 5-cleft. The lobes oblong, or of the upper leaves, lanceolate or oblong-linear, very sharply and incisely serrate, with bristle-pointed teeth; the uppermost leaves sessile; involucre two-leaved. Umbels of 3-5 rays which are longer than the involucels. Umbellets $2\frac{1}{2}$ " in diameter, exceeding the oblong-lanceolate and entire divisions of the involucel, globular, densely many-flowered. Flowers yellow, the male flowers short pedicelled and exterior; the female flowers sessile; their filiform styles exserted and recurved. Fruit ovate, 2" long, echinate throughout with long and stout hooked prickles.

Hawaii and East Maui, on the mountains.

3. *FOENICULUM* Adans.

Calyx teeth obsolete. Petals entire. Fruit oblong, somewhat cylindrical; the carpels rounded on the back; the 5 primary ribs thick and prominent, and the oil-tubes under the intervening furrows.—Biennial or perennial glabrous herbs, with pinnately decompound leaves, the segments linear; compound umbels with no involucre and yellowish flowers.

A small genus; one or more of the species now widely dispersed.

FOENICULUM VULGARE Gærtn. Stock perennial. Stems erect, branched, 2°-3° or more high. Leaves 3 or 4 times pinnate, with very narrow linear or subulate segments. Umbels of 15, 20 or more rays. Fruit about 3 lines long, the oil-tubes very conspicuous.

Abundantly introduced and naturalized in many places.

4. *DAUCUS* Linn.

Calyx 5-toothed. Corolla irregular. Fruit ovoid or oblong; the carpels scarcely flattened on the back, with 5 primary slender bristly ribs, two of them on the inner face, also with 4 equal and more or less winged secondary ones, each bearing a single row of slender bristly prickles: an oil-tube under each of these ribs.—Biennials, with finely 2-3-pinnate or pinnatifid leaves, cleft involucre, and concave umbels, dense in fruit.

A small genus mostly of the warm parts of America, and the Mediterranean region.

DAUCUS PUSILLUS Michx. (*Enum* No. 151.) Annual: stem rough with reflexed hairs; leaves twice pinnate, with the divisions linear. Umbels long-peduncled. Bristles of the fruit barbed.

Highlands of Hawaii, probably introduced. Native in the warm parts of North America. Leaves (pinnate, with 7 large ovate leaflets) only, of a large umbelliferous plant, were gathered on the mountains of Kauai, by the Naturalists of the United States South Pacific Exploring Expedition.

NOTE.

After a delay of about two years we find that it will be impossible to complete Mr. Mann's "Flora of the Hawaiian Islands" in this volume, as we anticipated doing at the time of the decease of our lamented friend. We are therefore obliged to close the "Flora" at the end of the Umbelliferæ.

While regretting that the work is not to appear in a complete form in the "Communications of the Institute," we have the satisfaction of announcing that the Government of the Hawaiian Islands, appreciating Mr. Mann's labors in developing the Flora of the kingdom, have made an appropriation for the publication of the completed work with illustrations. At Mr. Mann's death the manuscript of the monopetalous orders was nearly ready for the press. This was placed in the hands of William T. Brigham, Esq., Mr. Mann's companion in Hawaiian Explorations, who has since nearly completed the phænogamous portion of the Flora. — EDITOR.

VI. *Notes on the Birds of Minnesota.*

BY T. MARTIN TRIPPE.

THE following notes on the Birds of Minnesota were taken during the past year (1870) while the author was engaged in various railroad surveys in that State. They do not profess to contain a complete list of the avi-fauna of that region; indeed, probably not more than three-fifths of the species are mentioned, — and are merely the result of such facts as came under my observation while at work in the field.

The district embraced extends between Otter-tail Lake and Lake Mille Lacs. The period of observation was between April and December.

Although four hundred miles further north, most of the migratory species arrive in this region nearly as early as they do in the vicinity of New York. The Robin, Bluebird, and others that migrate on the appearance of spring, appear, it is true, some weeks later; but the great mass of birds, the Warblers, Flycatchers, Thrushes, etc., arrive nearly or quite as early. The season, indeed, is quite as far advanced here by the 10th of May, as it is in the neighborhood of New York:

The nomenclature is from Audubon's Synopsis.

1. *Cathartes aura*. Abundant; breeds. The Turkey Buzzard usually selects the hollow, prostrate trunk of a large tree for its nest. I found young birds scarcely fledged as late as the 29th of July. There are usually two young; occasionally but one. This bird is capable of withstanding considerable cold. I saw it on the 24th of October, and again on the 8th of December.

2. *Buteo borealis*. Not common.

3. *B. lagopus*. Seen a few times in the fall.

4. *Haliaeetus leucocephalus*. Rather common, especially in winter.

5. *Pandion haliaetus*. I saw but a single pair of these birds. They had fixed their nest in the top of a tall, dead pine on the banks of the Mississippi; and at that date, June 30th, the young were just hatched.

6. *Nauclerus furcatus*. Rather common, especially in the immediate vicinity of the Mississippi. It arrives early in June, and remains all summer. I saw this bird 30 miles north of Mille Lac, — lat. 47°.

7. *Falco peregrinus*. Seen a few times in autumn.

8. *F. sparverius*. Common; breeds. Found hatching in May.

9. *Circus cyaneus*. Common; breeds.

10. *Ulula Tengmalmii*? This, or a very similar species, was not unusual in the spruce and hemlock woods.

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11. *Syrnium nebulosum*. Not abundant.
12. *Bubo Virginianus*. Not common.
13. *Caprimulgus vociferus*. Very abundant. It arrives in the first week of May, and was seen as late as the 21st of September.
14. *Chordeiles Virginianus*. Abundant. Arrives about the middle of May, and leaves towards the close of August.
15. *Chætura pelasgia*. Not common.
16. *Hirundo purpurea*. Uncommon.
17. *H. bicolor*. Seen in great numbers in May, near the Leaf River, but not observed elsewhere.
18. *H. riparia*. Very common.
19. *Muscicapa tyrannus*. Very abundant. Arrives in the middle of May.
20. *Tyrannula minima?* Abundant. Possibly an allied species, though I think not. I saw also another species of *Tyrannula* which I took to be
21. *T. flaviventris*, though I might have been wrong. It was not very common.
22. *Muscicapa virens*. Common, especially near the Mississippi.
23. *M. ruticilla*. Seen once or twice in May.
24. *Sylvicola coronata*. Abundant. It appears towards the close of April, remaining for two or three weeks, then passing north. It reappears in the latter part of August, on its southward migration.
25. *S. Pennsylvanica*. Rather rare; breeds.
26. *S. pinus?* Not common; breeds.
27. *S. æstiva*. Rare.
28. *S. petechia*. Abundant in the early part of May; goes further north to breed.
29. *S. virens*. Common; breeds.
30. *S. Americana*. Rare. Seen only towards the latter part of August.
31. *S. Canadensis*. Not common; breeds.
32. *Trichas Marilandica*. Abundant. Appears in the middle of May.
33. *T. Philadelphia*. Abundant; breeds. The Mourning Warbler haunts the edges of tamarack swamps, and the damp thickets that adjoin them. I made frequent search for its nest, but was not fortunate enough to find it, though I repeatedly saw the old birds feeding the young in the latter part of June and early in July. They are similar in their habits to the Maryland Yellow-throat, but are not so exclusively devoted to thickets and underbrush, frequently ascending to the tops of the tamaracks, for which they show a great predilection. The Mourning Warbler has a very agreeable song, very similar to that of the Water Thrush, *Seturus Novæboracensis*.
34. *Mniotilta varia*. Common.

85. *Certhia familiaris*. Not very common; breeds in the tamarack swamps. A nest found May 9th, contained six eggs on which the bird had just begun to set. They were white with a very faint tinge of buff, and sprinkled with small spots of reddish brown, which are most numerous towards the larger end.

36. *Troglodytes Bewickii*. Common; breeds. I found a nest with seven young just hatched, on the 8d of July. The song of this bird is very similar to that of the House Wren, while in its habits it resembles the Winter Wren.

87. *T. ædon*. Possibly the preceding species was mistaken for this. The different Wrens are so similar in color and general appearance that it is very difficult to distinguish them except by close examination.

38. *T. hyemalis*. Not common; breeds.

39. *T. palustris*. Abundant; breeds. If not this species, one that agrees very closely with it in notes, habits and general appearance.

40. *T. stellaris*. Abundant; breeds.

41. *Parus atricapillus*. Abundant.

42. *Regulus satrapus*. Uncommon; does not breed.

43. *R. calendulus*. Uncommon; does not breed.

44. *Sialia sialis*. Abundant. The Bluebird breeds in great numbers in the interminable pine barrens and tamarack windfalls that extend over the greater portion of the northern half of Minnesota.

45. *Orpheus rufus*. Common.

46. *Turdus migratorius*. Rather common. It frequents the pine barrens, where it finds ample facilities for nesting. It avoids the tamarack regions.

47. *T. mustelinus*. Common. The cool, damp woods adjoining the tamarack marshes, are a favorite resort of this and other species of Thrushes.

48. *T. Wilsonii*. Common; breeds.

49. *T. Swainsonii*. Rather rare. Does not breed.

50. *T. solitarius*. Common. Does not breed.

51. *Seiurus aurocapillus*. Common.

52. *Anthus Ludovicianus*. Common, appearing by the first of September.

53. *Alauda alpestris*. Common.

54. *Plectrophanes Lapponicus*. Abundant. The Lapland Longspur arrives about the middle of September, and remains until December, when it moves further south, its place being supplied by the Snow Bunting. During the depths of winter and early spring it is very numerous in Southern Iowa, where the Snow Bunting is comparatively rare. The Longspur remains until the middle of May, and very probably breeds within the State.

55. *P. nivalis*. Abundant. Arrives in the latter part of November and remains till May.

56. *Emberiza graminea*. Abundant, breeding in great numbers in the pine barrens.

57. *E. socialis*. Common, frequenting similar situations with the preceding.

58. *E. Canadensis*. Not very common. In early winter it is extremely abundant in Southern Iowa, but it removes further south during the severest weather. Not observed during summer.

59. *Niphaea hyemalis*. Common; breeds. The Snowbird usually nests in the pines, or on a brushy hillside. The nest is placed on the ground, and is very artfully concealed. The young are able to fly by the middle of June. The Snowbird goes further south in winter; very few remain, even in Southern Iowa, during the most inclement season.

60. *Ammodromus palustris*. Common.

61. *Linaria minor*. Very abundant. The Lesser Redpoll appears in vast numbers, about the middle of October, and remains during the entire winter, proceeding northward, however, some weeks before the Snow Buntings and Longspurs. In its habits, it very strongly resembles the Yellowbird; its notes, too, are very similar, and on their first arrival, the males may sometimes be heard singing the same pleasing song that the Yellowbird sings in May or June.

62. *L. pinus*. Observed in great numbers in the fall. Migrates south in winter.

63. *Carduelis tristis*. Uncommon.

64. *Fringilla iliaca*. Uncommon. A few seen in spring and fall.

65. *F. melodia*. Abundant. The Song Sparrow breeds in great numbers in the brush prairies and along the river valleys, but avoids the pine and tamarack regions. Like the Robin, Bluebird and Chipping Sparrow, it is a far shyer and wilder bird here than in the settled parts of the country.

66. *F. Pennsylvanica*. Abundant. Breeds in the tamarack swamps and windfalls.

67. *F. leucophrys*. Common near the Leaf River, where it breeds.

68. *Pipilo erythrophthalmus*. Common.

69. *Erythrospiza purpurea*. Abundant in fall; not seen during summer.

70. *Corythus enucleator*. Appears about the middle of November, and remains throughout the winter, feeding on the buds and seeds of the alder, birch, etc., as well as of the weeds that abound on the prairies. As with the Redpoll and Snow Bunting, there is a much larger proportion of old birds than there is in the flocks that visit the vicinity of New York, though the adult males are still far outnumbered by the females and young.

71. *Loxia curvirostra*. Very abundant; breeds. I never saw it out of the pinneries.

72. *Coccyzus ludovicianus*. Rather common.

73. *Pyranga rubra*. Common.

74. *Dolichonyx oryzivorus*. Not common.

75. *Molothrus pecoris*. Rare.

76. *Agelaius xanthocephalus*. Seen rarely, and only in spring.

77. *A. phæniceus*. Not very common.

78. *Icterus baltimorensis*. Rather common. Its favorite haunts are among the tall Norway pines. Arrives about the middle of May.

79. *Quiscalus versicolor*. Abundant; breeds.

80. *Q. ferrugineus*. Very abundant as far west as the Red River. It disappears about the middle of May, and returns in September.

81. *Sturnella neglecta*. Common on all the prairies. Whether this bird is really distinct from *S. ludovicianus* seems to be rather doubtful. The notes of the Western Lark are certainly widely different from the Eastern; and this difference appears to be the main distinguishing point between them. In Southern Iowa both varieties are to be found; and a series of careful observations satisfied me, that, while *S. neglecta* rarely utters the ordinary whistle of *S. ludovicianus*, the latter, in turn, though inhabiting the same fields with the former, never gives utterance to its peculiar warble. Here, the *S. neglecta* alone is to be found, and I have never heard it whistle in the manner of the Eastern bird.

82. *Corvus americanus*. Common. None remain during winter. In Southern Iowa it is quite common at that time.

83. *Garrulus cristatus*. Common. Resident.

84. *G. canadensis*. Common; breeds. In summer it haunts the dense gloomy tamarack and spruce swamps, where it breeds. Although it is so abundant, I could not find its nest; but I have reason to believe it builds in the tops of the thickest spruce and fir trees.

85. *Lanius borealis*. Common in spring and fall.

86. *Vireo solitarius*. Not very common; breeds.

87. *V. noveboracensis*. Not common.

88. *V. olivaceus*. Uncommon.

89. *V. flavifrons*? Rare.

90. *V. gilvus*? Possibly *V. philadelphicus*. Not common.

91. *Bombycilla carolinensis*. Abundant.

92. *Sitta carolinensis*. Abundant; breeds.

93. *S. canadensis*. Abundant. Less so, in summer, but many remain to breed.

94. *Trochilus colubris*. Rather common.

95. *Alcedo alcyon*. Abundant.

96. *Picus pileatus*. Not common.

97. *P. villosus*. Abundant; resident.
98. *P. pubescens*. Less abundant than the preceding.
99. *P. arcticus*? Not common; breeds.
100. *P. erythrocephalus*. Abundant. I was much surprised to find that the Red-bellied Woodpecker, *P. Carolinus*, does not inhabit this region. During winter it is exceedingly abundant in Southern Iowa, from which section great numbers migrate on the approach of spring. I had supposed that it crossed over the prairies of Iowa and the southern part of Minnesota, and passed the breeding season in the woods of the northern part of the latter State. I found this to be a mistake, however, as I did not see a single individual during the whole year.
101. *P. auratus*. Very abundant. In spring, the Golden-winged Woodpeckers frequent the prairies in great numbers, venturing many miles from the nearest timber.
102. *Coccyzus Americanus*. Possibly the following species.
103. *C. erythrophthalmus*. Not common; breeds.
104. *Ectopistes migratoria*. Very abundant.
105. *Ortyx Virginiana*. The Quail is very abundant in the southern portion of the State, and is gradually extending northward as the country is settled. In the new settlements it is rare; beyond the settlements, wholly unknown.
106. *Tetrao umbellus*. Abundant. The Ruffed Grouse in this part of the country has the rufous chestnut of the back and tail more or less replaced by ashy gray. In four out of five birds, there is no trace of red whatever on the tail, while on the back and scapulars it is more restricted, and not as bright as in southern and eastern birds. This is interesting, as showing an approach to the Gray Ruffed Grouse, *T. umbelloides*, of the Rocky Mountain region. The Deer, *Cervus Virginianus*, and the Red Squirrel, *Sciurus Hudsonius*, are also far more gray than southern specimens.
107. *T. Canadensis*. Abundant; breeds.
108. *T. phasianellus*. Very common. In its habits and notes, this species bears a very strong resemblance to the Pinnated Grouse, which it replaces on the prairies of the Upper Mississippi and its tributaries. I never saw the Pinnated Grouse in this part of the State, nor could I learn that the Sharp-tailed Grouse ever visits the southernmost counties, where the former species is very abundant.
109. *Fulica Americana*. Abundant; breeds.
110. *Rallus Virginianus*? Not very common; breeds.
111. *Grus Canadensis*. Very common; breeds in extensive swamps.
112. *G. Americanus*. I saw but few White Cranes, though I was told that they are quite common at certain seasons of the year, and that they occasionally breed here.

- 113. *Charadrius vociferus*. Common.
- 114. *Tringa Bartramia*. Abundant.
- 115. *Totanus macularius*. Common.
- 116. *T. solitarius*. Uncommon.
- 117. *T. flavipes*. Common.
- 118. *T. vociferus*. Common.
- 119. *Limosa fedoa*. Abundant in spring.
- 120. *Scolopax Wilsonii*. Rather common, but not observed to breed. It arrives in the latter part of April, and remains until the middle or close of October. I did not see the Woodcock, though the country, in many places, is admirably suited to its peculiar habits.
- 121. *Numenius longirostris*. Seen once or twice in spring.
- 122. *Ardea lentiginosa*. Common; breeds.
- 123. *A. virescens?* Rare.
- 124. *Anser Canadensis*. Abundant. A few breed around the marshes and lakes.
- 125. *A. albifrons*. Common in spring and fall.
- 126. *A. hyperboreus*. Common in spring and fall.
- 127. *Cygnus buccinator*. Not common.
- 128. *Anas boschas*. The most numerous species of Duck. The greater number go north to breed, but many remain, nesting in the marshes and bogs.
- 129. *A. acuta*. Not common.
- 130. *A. sponsa*. Very abundant.
- 131. *A. Carolinensis*. Abundant in spring and fall, but not observed during the breeding season.
- 132. *A. discors*. Common.
- 133. *Fuligula ruftorques*. Common.
- 134. *F. albeola*. Abundant.
- 135. *Pelecanus Americanus*. Common in spring and fall.
- 136. *Sterna nigra?* Several species of Terns and Gulls breed around the lakes and ponds.
- 137. *Colymbus glacialis*. Abundant; breeds.
- 138. *Podiceps Carolinensis*. Very common.

VII. *Note on the Earth Worm.*

BY R. T. KNIGHT.

I find that the Earth Worms leave their holes just before dark. When mated they appear double the thickness and about ten inches long. I have seen several of that length, and they are generally considered as one worm.

The mouth is at the anterior extremity, and is an opening large enough to enable the worm to swallow grass clover, and to carry pellets of earth fully as thick as its body. It turns the mouth down so as to resemble that of the sucker fish, and it seems to use the upper part of the mouth as the elephant does the prehensile tip of his trunk.

Recently I saw two large worms united at or near one end, both tails were in the ground; the one on the ground had a concavity extending for several inches on the upper side. The upper worm being connected at the other end, raised the forward part of the body (say nearly two inches long) half an inch above this concave portion and drew it back, then depressing itself till it laid in the groove and pushed itself forward, thus rubbing over the sensitive portion of the worm which was of a yellowish red color, and the groove was covered with a garish fluid. This motion I saw repeated about ten times in succession.

VIII. *Synopsis of the Primary Subdivisions of the Cetaceans.*

BY THEODORE GILL, M.A., M.D., Ph. D.

THE interest that is now being manifested in the Cetaceans has induced me to submit for publication, in advance of similar series for all the mammals, the following series of dichotomous tables of the subdivisions of the order, so far as the suborders, families, and sub-families are concerned. In the compilation of these tables, I have not only made use of all the material at my disposal, but have availed myself of all the publications on the order as a whole, as well as on its various members. But more especially have I been indebted to the various publications of Professor William Henry Flower, from whose views I have rarely ventured or found cause to dissent.

There are probably few, if any, modern naturalists who have seriously studied the Cetaceans, who do not now consider those animals to be most nearly related to the Carnivores, or Feræ. Between the latter and the Cetaceans of the present age, the gap does indeed appear to be very great, but it is bridged over, to a very considerable extent, by the Zeuglodonts of the Tertiary epoch, and those forms so resemble in some features the Pinnipeds, that the two groups have been combined by more than one naturalist—but notably by Giebel—in the same order. They may indeed be considered as derivatives from the same original stock, and from the Zeuglodont stem have probably descended, in different directions, the Toothed and Whalebone Whales. While the former, in some features, such as the general form of the skull, the teeth, etc., appear to deviate less from ordinary mammals, the latter, in other respects, but especially in the development of the olfactory organ and of the nasal bones, depart less than they from the typical forms. It would therefore seem probable that the *Denticete* have become differentiated as now recognized, little or not at all in advance of the *Mysticete*, or in other words, that the latter are not offshoots from the former, but both from one original stock.

A list of the genera is appended to enable the reader to understand the range of the groups, but no pretense to critical accuracy is made in its behalf, some generic names being admitted for groups which are scarcely of generic value, while other genera, based on extinct species, are omitted, chiefly on account of the doubts relative to their relations.

§ 1. SYNOPSIS.

SUBORDERS.

- I. Intermaxillaries expanded forwards, normally interposed between the maxillaries, and forming the terminal as well as anterior portion of the lateral margin of the upper jaw. Nasal apertures produced more or less forwards. Teeth of the intermaxillaries apparently in normal number (3+3), conic; of the maxillaries, 2- or 3-rooted. **ZEUGLODONTIA.**
- II. Intermaxillaries narrowed forwards, forming only the point of the lower jaw, and underlaid by the maxillaries, which form the entire lateral alveolar margins of the jaw. Nasal apertures far back, near the vertex. Teeth (when present) all single rooted.
 1. Teeth persistent after birth. Upper jaw without baleen. Rami of lower jaw united by a symphyseal suture. Olfactory organ rudimentary or absent; the nasal bones being appressed on the frontals and overlapped distally. **DENTICETE.**
 2. Teeth absorbed and disappearing before birth. Upper jaw provided with plates of baleen. Rami of lower jaw not united by suture. Olfactory organ distinctly developed; the nasal bones projecting forwards, and free at their distal ends. **MYSTICETE.**

ZEUGLODONTIA.

FAMILIES.

- I. Anterior nares open forwards; nasal bones elongated. **BASILOSAURIDÆ. (I.)**
- II. Anterior nares open far behind; nasal bones short. **CYNORCIDÆ. (II.)**
 - I. **BASILOSAURIDÆ** Cope.
 - II. **CYNORCIDÆ** Cope.

DENTICETE.

FAMILIES.

- A. Rostrum of skull with a rounded apex.
 - I. Upper jaw rostrated and attenuated, or ledge-like around the margin. Skull with the vertex produced forwards. Supraoccipital not projecting

forwards laterally above the temporal fossæ. Frontals visible above only as elongated hook-shaped borders produced backwards around the maxillaries.

- a. Costal cartilages not ossified. The tubercular and capitular articulations of the ribs blending together posteriorly. (Flower.) Lachrymal bones coalesced with the Jugals. Orbit very small. PLATANISTIDÆ. (III.)

- b. Costal cartilages firmly ossified. Posterior ribs losing their capitular articulation, and only uniting with the transverse processes of the vertebræ by the tubercle. (Flower.) Orbits moderate. DELPHINIDÆ. (IV.)

- c. Costal cartilages not ossified. The hinder ribs losing their tubercular, and retaining their capitular articulation with the vertebræ. (Flower.) Lachrymal bones distinct from the Jugals. ZIPHIIDÆ. (V.)

II. Upper jaw not rostrated or marginated; snout high towards the front and projecting beyond the mouth. Skull raised behind and retrorsely convex. Supraoccipital projecting forwards laterally above the temporal fossæ. Frontals visible above as erect triangular or *retrorsely* falciform wedge between the maxillaries and supraoccipital.

PHYSETERIDÆ. (VI.)

B. Rostrum of skull prolonged into a slender, straight beak, the premaxillary and maxillary bones forming a cylinder, bearing teeth on its proximal portion.

RHABDOSTEIDÆ. (VII.)

III. PLATANISTIDÆ Flower.

SUBFAMILIES.

1. Maxillary bones with crests null or little developed. Many of the teeth with a complete cingulum, or a distinct tubercle at the base of the crown.

- a. Postorbital and zygomatic processes disconnected. Jugal with a well developed, curved, ante-orbital process. Maxillary not contracted, without crest, and with convex free margin at suborbital region.

INIIDÆ.

- b. Postorbital process and zygomatic process of squamosal connected. Frontal with a little developed ante-orbital tubercle. Maxillary contracted, with a crest and free margin over suborbital region. **PONTOPORINÆ.**
2. Maxillary bones with large bony incurved crests. Teeth without cingulum or tubercles. (Visual organs rudimentary. External respiratory apparatus longitudinal.) **PLATANISTINÆ.**

IV. DELPHINIDÆ Flower.

SUBFAMILIES.

1. Digits with not more than 4-5 phalanges to each.
- a. Cervical vertebræ all distinct. **DELPHINAPTERINÆ.**
- b. Cervical vertebræ more or less (2 to 7) consolidated. **DELPHININÆ.**
2. Digits with numerous phalanges. **GLOBIOCEPHALINÆ.**

V. ZIPHIIDÆ Gray.

SUBFAMILIES.

- I. Maxillaries with no incurved lateral crests. **ZIPHIINÆ.**
- II. Maxillaries with greatly developed incurved crests. **ANANARCINÆ.**

VI. PHYSETERIDÆ Gray.

SUBFAMILIES.

1. Head very large, truncated in front. Blow-hole near the edge of the snout. Cerebral cavity declining downwards. Jugal and zygomatic process of squamosal connected. **PHYSETERINÆ.**
2. Head moderate, conic in front. Blow-hole frontal. Cerebral cavity inclining upwards. Jugals and zygomatic processes of squamosals remote. **KOGGINÆ.**

VII. RHABDOSTEIDÆ Gill.

MYSTICETE.

- I. Cervical vertebræ separated in whole or in part. Digits 4. **BALÆNOPTERIDÆ. (VII.)**
- II. Cervical vertebræ coalesced. Digits 5. **BALÆNIDÆ. (IX.)**

VIII. BALÆNOPTERIDÆ Gray.

SUBFAMILIES.

- I. Throat not plicated. Dorsal fin null. **AGAPHELINÆ.**

II. Throat longitudinally plicated. Dorsal fin developed.

- a. Dorsal fin hump-like. Pectorals very long,
with the four digits segmented into many
phalanges.

MEGAPTERINÆ.

- b. Dorsal fin high, erect, falcate or subfalcate.

Pectorals moderate, with the four digits,
each having four to six phalanges.

BALÆNOPTERINÆ.

IV. BALÆNIDÆ Gray.

§ 2. LIST OF GENERA.

A. ZEUGLODONTIA.

I. BASILOSAURIDÆ.

Basilosaurus Harl. = *Zeuglodon* Owen.

II. CYNORCIDÆ.

Cynorca Cope.

Squalodon Grat.

Colophonodon Ledy.

Stenodon Van Ben.

B. DENTICETE.

III. PLATANISTIDÆ.

PONTOPORINÆ.

Pontoporia Gray.

Lophocetus Cope (extinct).

ININÆ.

Inia D'Orb.

PLATANISTINÆ.

Platanista Cuv.

GENERA INCERTÆ SEDIS.

Tretosphys Cope (extinct).

Priscodelphinus Cope (extinct).

Zarhachis Cope (extinct).

IV. DELPHINIDÆ.

DELPHINAPTERINÆ.

Delphinapterus Lac., Lillj. = *Beluga* Gray.

Monodon Linn.

DELPHININÆ.

Delphinus Linn.

Tursiops Gerv. = *Tursio* Gray.

Lagenorhynchus Gray.

Sotalia Gray.

Steno Gray.

Leucorhamphus Lillj. = *Delphinapterus* Gray (not Lac.).

Pseudorca Reinh.

Orca Gray.

Orcuella Gray.

Phocæna Gray.

Neomeris Gray.

Sagmatias Cope.

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Globiocephalus Gray. GLOBIOCEPHALINÆ.

V. ZIPHIIDÆ.

ZIPHIINÆ.

Ziphius Cuv. (= *Eptodon* Gray).

Berardius Duv.

Mesoplodon Gerv. (= *Ziphius* Gray).

Dioplodon Gerv.,
et al. (extinct).

ANARNACINÆ.

Anarnacus Lac. = *Hyperoodon* Lac.

VI. PHYSETERIDÆ.

PHYSETERINÆ.

Physeter Linn. = *Catodon* Gray + *Physeter* Gray + ? *Meganeuron* Gray.

KOGIINÆ.

Kogia Gray.

GENERA INCERTÆ SEDIS.

Orycterocetus Ledy.

Callignathus Gill.

Ontocetus Ledy.

Rhabdosteus Cope.

VII. RHABDOSTEIDÆ.

C. MYSTICETÆ.

VIII. BALÆNOPTERIDÆ.

AGAPHELINÆ.

Agapheius Cope.

Rhachianectes Cope.

Megaptera Gray.

MEGAPTERINÆ.

Eschrichtius Gray.

Physalus Gray.

BALÆNOPTERINÆ.

Sibbaldius Gray.

Balænoptera Lac.

IX. BALÆNIDÆ.

Balæna Linn.

Hunterius Gray.

Eubalæna Gray.

Palæocetus Seeley (extinct).

IX. *On the Myology of the Ornithorhynchus.*

BY ELLIOTT COUES.

ALTHOUGH the Ornithorhynchus has been repeatedly dissected in Europe, such is not the case in this country; where, moreover, no treatise on its anatomy is generally accessible. We publish, therefore, notes of a recent dissection of the muscles, rather with the design of partly supplying a want that many students must have felt, than with the idea of advancing anything new or specially important; although, we should add, some of the muscular homologies are discussed upon a hypothesis of antero-posterior symmetry not yet generally received. We are indebted to Prof. Agassiz for the use of a specimen from the Museum of Comparative Zoölogy, Cambridge, received through the kind attentions of Prof. Wilder; an adult male, in good condition, except that the head was severely shattered by a charge of small shot.

We find it convenient to group the muscles in the following manner, which probably, also, is not entirely unnatural:—

I. CUTANEOUS MUSCLES.

II. VERTEBRAL MUSCLES.

a. *Of the Head.*b. *Of the Neck.*

a'. Anterior vertebral.

b'. Posterior vertebral—and not upward prolongation of dorsal muscles.

c. *Of the Back.*d. *Of the Tail.*

III. CERVICAL MUSCLES:—superficial, not connected with vertebræ or scapula.

IV. THORACIC MUSCLES. (Intrinsic.)

V. ABDOMINAL MUSCLES. (")

VI. PERINEAL MUSCLES. (")

VII. MUSCLES CONNECTING THE SHOULDER-GIRDLE WITH THE BODY.

VIII. MUSCLES OF THE ANTERIOR EXTREMITY.

a. *Acting upon the humerus.*

a'.—From the body; "long."

b'.—From the scapular arch; "short."

b. *Acting upon the forearm.*

a'.—From the body; "long."

b'.—From the scapular arch;—"long."

c'.—From the humerus;—"short."

c. Acting upon carpo-metacarpus, from humerus or forearm.

d. Acting upon digits.

a'. — From humerus or forearm.

b'. — From carpo-metacarpus.

IX. MUSCLES CONNECTING THE PELVIS WITH THE BODY.

X. MUSCLES OF THE POSTERIOR EXTREMITY.

a. Acting upon the femur.

a'. — From the body; "long."

b'. — From the pelvis; "short."

b. Acting upon the leg.

a'. — From the body; "long."

b'. — From the pelvis; "long."

c'. — From the femur; "short."

c. Acting upon the tarso-metatarsus from femur or leg.

d. Acting upon the digits.

a'. — From femur or leg.

b'. — From tarso-metatarsus.

The intrinsic muscles of special organs belong rather to a treatise upon those organs than to one upon the general muscular system, and are not included in the present memoir.

I. CUTANEOUS MUSCLES.

The animal may be said to be tied up in a fleshy sack, with six principal openings for the head, tail, and four limbs. This muscular tunic is remarkable not only for its great extent, but for its thickness in most parts, the various directions of its fibres, and the number and diversity of its accessory slips and their attachments. It is everywhere intimately adherent to the skin; so closely, that in fact it is difficult or impossible to dissect it cleanly from the integument. On the other hand, its connection with the body is correspondingly loose, through the medium of copious areolar tissue especially lax and abundant over the back, chest and sides, dwindling over the episternum and front of the neck, and giving out on the limbs. Practically it will be found best to raise the panniculus with the skin in large, well defined flaps (taking care to note its several definite bony attachments), clear off the cellular tissue, and study it from the inner side. It will be found to descend upon the limbs nearly to the wrists and ankles, where it is drawn tight, like the wristband of a sleeve. The muscle may be further described in detail as follows:—

Panniculus carnosus.—It begins behind by a pointed extremity on either side of the tail near its base, made up by several (about four) fleshy digitations arising from as many transverse processes of coccygeal vertebræ—the first or anterior digitations being opposite the great caudo-tibial muscle. The two sides of the muscle soon come together over the back of the tail, there forming a deep reëntrant angle; after thus joining, the single plane, at once becoming very thick,

runs up the back and sides with uninterrupted longitudinal fibres. On the ventral surface of the tail, there is a similar coalescence of the two sides, at a point just in front of the anus, or just behind where the *intertibialis* crosses from one side to the other; the plane, thinner than that on the back, runs uninterruptedly up over the belly.

Some distance behind the leg, the longitudinal fibres part on the side of the body preparatory to forming the leg-opening. But across the triangular space that would thus be left, semicircular loops are thrown, with less and less belly from behind forward, until they are nearly transverse just at the back of the leg; these sweep around the leg on both sides, embracing it and then coming together again in front of it; the opening thus made is pyriform in shape, with the point forward. A little above the heel, the muscle and skin together are pretty firmly attached, not only to a naked space on the tibia, but by dense areolar or fascial extensions, containing much fat, betwixt the tendons of the muscles.

Where the *intertibialis* crosses, this is firmly connected with the panniculus, though not to any special detached slip of the latter that we could discover.

Uninterruptedly surrounding the whole body, and with simple longitudinal fibres, the muscle runs up to the neck. The provision for the arm-opening is essentially the same as that for the leg-hole, only the point of the pyriform orifice is directed backward; the muscle descends on the arm; some fibres have definite attachment to the lower third of the ulna; others less definite fascial connection on the other side, with the lower end of the radius, and with the septa betwixt the flexor tendons of the wrist.

A few longitudinal fibres are continued from the breast up to the neck; with the exception of these, and of the hyoid fasciculus, to be presently noticed, the fibres are here transverse, without a median raphé, and sweep over the sides of the neck; they extend quite to the back, and overlies the cheek-pouches. These transverse fibres, and in general, all of the muscle upon the ventral aspect of the body, are thinner than those on the dorsal; and there is a remarkable thickening, as a longitudinal band, along the side of the neck, formed in a manner noticed below.

Its special slips and their attachments. — An *hyo-dermal* muscle is thus formed: Over the episternal bar, a curved fan- or horn-shaped set of fasciculi are developed from the inner surface of the panniculus; these curve inward as they pass forward, narrowing to definite fleshy insertion into the body of the *os hyoides*, on either side of its median line, in mutual apposition. A *brachio-dermal* is formed over the *latissimus* and side of the thorax generally, by a heavy reinforcement to the inner surface of the muscle, of a broad, fan-shaped plane growing

thicker and narrower as it passes forward to definite insertion (fleshy, or by a very short tendon) into the pectoral crest of the humerus, alongside the insertion of the *pectoralis major*. The anterior border of this *dermo-brachialis* corresponds in a general way with the posterior border of the great pectoral. A third distinct slip, large and important, forms what may be called the *costo-dermal fasciculus*. It arises by two definite fleshy digitations from the 12th-13th ribs, respectively 1' and 1½' from the back-bone, and forms a long, slender, flat ribbon, that runs straight up the side of the body along the anterior border of the lower trapezius, underneath the main plane of the panniculus, lying upon the latissimus, to the shoulder; passing just behind the elbow, widening over the shoulder, becoming then blended with the panniculus along the side of the neck, then separating again, and finally inserted into the back part of the cheek-pouch.

In considering the form and uses of this great muscle, probably representing the extreme case of its development in the mammalian series, we are struck first with its nearly equal and essentially symmetrical presence on both the anterior and posterior halves of the body. Acting as a whole we see how, in connection with the thick skin, dense fur, and subjacent flocculent areolar tissue, it contributes to fill up the various irregularities of the surface of the body, and produce a shape offering least resistance in passing through the water; while, moreover, this everywhere contractile tunic must largely assist in producing the various undulatory motions of a body suspended in a fluid of nearly its own specific gravity. Its two lateral caudal prolongations resemble tiller-ropes to guide the side motions of the rudder-like tail; its two lateral costal slips bend the whole body sideways. The hyoid slip is a retroductor of that bone, in action intermediate between sterno- and omo-hyoid. The brachial fasciculus acts like an accessory *pectoralis major*. The cheek-pouch slip pulls that organ directly backward, and appears to be in antagonism with the special orbicular muscle that surrounds and contracts the pouch; while the transverse fibres that spread over the latter compress it and assist the orbicular muscle in emptying it. (The dissection was here a little obscure, owing to laceration of the parts; but we believe such is the arrangement.) Finally, the fascial attachment of the muscle at the lower arm and leg, where the limbs protrude through the orifices, renders the panniculus an accessory mover of the limbs in various directions.

II. VERTEBRAL MUSCLES.

a. Of the Head.

Unfortunately, the shattered state of the parts prevented any satisfactory dissection here.

b. Of the Neck.

(a'. — Anterior vertebral.)

Scalenus.—There is but one—a small insignificant slip proceeding to the first rib, to be inserted opposite the origin of the first digitation of the *serratus magnus*. It lies on the extreme side of the neck, just in front of the cervico-scapular muscle, and appears to begin there, with attachment at the middle of the neck; but it is really continuous by a slight tendinous intersection, with a portion that runs higher up, with attachments all along to its real origin, definite, at the apex of the spur of the hypapophysis of the atlas.

Longus colli.—An upper portion is not demonstrably distinct from the lower; its place is apparently taken by the unusually large muscle next succeeding. The muscle lies upon the bodies of the vertebræ, with attachments by slips as usual to 5-6 processes, from first dorsal upward; below, it terminates inside the chest.

Rectus capitis anticus major.—Large; arising both tendinous and slightly fleshy from the basioccipital just in front of the articulation, passing down over the hypapophysis of the atlas without attachment thereto, in apposition with its fellow; forming a distinct fleshy fusiform belly, traversing the whole length of the neck in front, with attachments by slips to the anterior aspect of transverse processes, more or less blended with the similar digitations of the *longus colli*.

R. c. a. minor?, or *lateralis?* (possibly neither, as it has no origin from the atlas).—A rather large muscle, arising fleshy from the whole length of the transverse process of the axis, passing upward across the atlas, between its transverse process and its hypapophysial spur, narrowing as it ascends, to the head (insertion destroyed in the specimen). Just back of this muscle, and appearing like a prolongation of it, interrupted by the transverse process of the atlas, a little muscular plane runs from the process just named to the roots of the spinous processes of 3d-4th cervical vertebræ. This is entirely distinct from the series of cervical *intertransversales*.

(b'.—Posterior vertebral—and not upward prolongation of dorsal muscles.)

The two *recti capitis postici*, if these occur, were completely destroyed.

Obliquus inferior.—Of great size, as in some marsupials that, like *Didelphys*, have greatly developed cervical spinous processes; and resembling a second *complexus*, but of course without cranial attachment. A bulging fleshy mass, arising muscular from the sides of the spinous processes of axis and next 3 vertebræ, by 4 digitations; passing obliquely upward and outward to be inserted fleshy into the whole upper surface of the transverse process of the atlas. A powerful rotator of the head, as in the action of shaking it sideways.

O. superior.—A small terete muscle, arising fleshy from the poste-

rior corner of the edge of the transverse process of the atlas, and proceeding straight up to—— (the head?—insertion destroyed).

Splenius.—(Upper half much mutilated); apparently no distinction of *S. "capitis"* and "*colli*." Below, a large, rather thin, fleshy plane, passing a little obliquely from the head downwards toward the middle line of the neck; terminating about opposite the last cervical vertebra, where, and for a little distance below, it is united with its fellow by a tendinous raphé. Superficial, with the usual relations to all deep-seated muscles.

Complexus.—(Destroyed above); below, an oblique plane, of rather small size, just internal to the *trachelo-mastoideus*; inserted by about 4 fleshy digitations into the spinous processes of as many lower cervical vertebrae.

Bicenter.—(Mostly destroyed); but, as well as we can determine from the mutilated remains, differentiated from the *complexus*; a terete fascicle along the median line of the back of the neck, with no tendinous intersection.

Trachelo-mastoideus.—(Destroyed above; arises from mastoid.—Owen); below, a mostly distinct and rather terete than digitate muscle, separating *complexus* from "*transversalis colli*," and somewhat blended with the latter. No tendinous intersections observed; insertion by about 3 closely approximated, and in fact, blended, thick, fleshy digitations, into the bases of the transverse processes of as many lower cervical vertebrae.

c. *Of the Back* (with their cervical prolongations).

Not to enter upon details alike tedious and fruitless, we may rather briefly notice the conformation of the special muscles of the back.

Disregarding for the time the caudal prolongation of the *longissimus*, the *erector spinæ* may be said to begin over the pelvis opposite the tip of the ilia; it is at the outset completely differentiated into "*longissimus dorsi*," or erector proper, and "*sacro-lumbalis*" or "*iliocostalis*;" the latter, separate in its whole extent, is not further divided into a "*musculus access. ad s.-lumb.*;" it continues up the neck as "*transversalis colli* and *cervicalis ascendens*," which are separated by the *trachelo-mastoid* and *complexus* from the corresponding cervical prolongations of *longissimus* proper, viz., *semi-spinalis dorsi et colli*, and *multifidi*. To this general indication we may add the following descriptions:

Longissimus.—In the loins a remarkably distinct, flattened terete belly, almost wholly muscular, without dense aponeurotic investment, and with only a few (3-4) distinct fasciculi or digitations, that arise from lumbar transverse processes. Already differentiated, as just said, from *sacro-lumbalis*, the muscle runs upward with a nearly uniform width, and straight, somewhat free, outer border; opposite the last

rib it becomes invested with a glistening aponeurosis, at first slight plain and single, but readily resolvable (more especially a little higher up) into a series of oblique fascial tendons running inward and upward, with pretty definite insertion into apices of successive transverse processes; the arrangement is clearest at the top of the thorax but is essentially the same throughout. Now on raising the outer border of the whole muscle, and dividing successive costal attachments so as to reflect it over towards the spine and expose its under surface, a perfectly regular series of tendino-muscular slips is brought to view. Counting 2-3 lumbar ones, there are about 14 in all, arising distinct and tendinous, from transverse processes, passing obliquely upwards and outwards. These are best displayed along the middle of the back; they terminate opposite the 3d and 4th ribs, at least as far as *longissimus dorsi* is concerned, being transferred to the outer (costal) branch of the erector (*i. e.*, cervical prolongation of *sacro-lumbalis* = "*transversalis colli*"). Above this point the *longissimus* dwindles into characters of *semi-spinalis dorsi et colli*; and the few muscular-tendinous fibres pass obliquely downward and outward, instead of upward and outward, like those of the back. External to these, "*transversalis colli*" lies along the side of the neck, betwixt the digitate insertion of the *trachelo-mastoid* and the "*cervicalis ascendens*," blending with both of these. It may be said to arise from the most prominent transverse processes of cervical vertebræ, by tendon scarcely separable from that of the *c. ascendens*; it passes downward and obliquely backward, ending with *longissimus* opposite the 3d and 4th ribs, with fascial attachments all the way.

Sacro-lumbalis.—This is the outermost of three different planes that may be distinguished in the loin (*longissimus* making a fourth). It is there a thin fan-shaped plane, taking definite origin from the tip of the ilium, and passing upward spreading over the ribs. This costal expansion is continuous over the whole length of the thorax (with no differentiation into "*musc. accessorius*"), and entirely separate from any part of the *longissimus*; it is wholly costal, without vertebral attachment. It is an inch and a half broad at its widest part; its outer border is very convex, and runs a little back of the line of the digitations of the *obliquus abdominis*; its inner or posterior border is straight, and corresponds with the outer border of the *longissimus*; the plane is very thin, and intimately attached to each rib as it passes over it; to the eye, in fact, it resembles a set of supernumerary intercostals, with perpendicular instead of oblique fibres; we should judge it to be more of a respiratory muscle than a back-straightener. Towards the top of the thorax it grows narrower, and becomes, on the neck, *cervicalis ascendens*, differentiated from other nuchal muscles by the intervention of *trachelo-mastoideus*, and

lying the most laterally of any of them. It finishes by insertion, by an aponeurosis of blended tendons, into the 4-5 lower cervical vertebræ, at the apices of their transverse processes.

A second lumbar plane is thicker and narrower; like the last, it arises from the apex of the ilium, and runs to the last rib; it may be a disintegration from the sacro-lumbalis; but it seems to represent lumbar continuation of a series of 'levator costarum'?

Quadratus lumborum.—This is rather thin, subtriangular, arising, like the two last, from the iliac extremity and passing to the last and next to the last, rib, with attachment also to vertebræ on its way.

Thus there is no very remarkable deviation from a usual standard, nor any specially interesting conformation of the cervico-dorsal vertebral muscles. Among notable absentees, however, the *serrati postici* may be mentioned. As a whole, the back muscles are not very large; those of the nape exceed them, comparatively; and these again are surpassed in development and complexity of structure by the caudal muscles destined to move the great heavy thick-skinned, fat-laden tail that acts as a rudder when the animal is swimming.

d. Of the Tail.

Levator caudæ.—This is the uninterrupted prolongation of the longissimus to the tip of the tail. As the muscle passes down over the back of the sacrum, it forms a single thick terete fleshy belly on either side, filling the deep groove between the ilium and vertebral spines, soon tapering and filling the similar groove on either side between spinous and articular processes of caudal vertebræ, with attachments all along its course. These last consist, on the upper part of the tail at least, of distinct tendons terminating the muscular fasciculi that are given off; they are implanted into zygapophyses. Towards the tip of the tail, such definite arrangement is scarcely or not demonstrable.

Extensor lateralis.—The median extensor of the tail is small compared with this lateral one that forms the chief bulk of extending muscle. The latter is incompletely divisible above into two portions; the larger one arises from the back of the iliac extremity; the smaller and more lateral portion lower down on the same bone; the two are afterward blended. The superior part mostly fills the fossa between articular and transverse processes, lying upon the latter. Its upper surface is invested with a strong dense fibrous sheath, that may be split into numerous tendons, each of which arises from a partly differentiated muscular fasciculus. Tendons thus extend to the tip of the tail, but most of them pass a little obliquely inward towards the median line for insertion,—an arrangement most obvious along the middle of the tail. The lateral bundle of the muscle gives off from its border and under surface about 6 distinct tendons from muscular fasciculi, that pass to definite insertion into the tips of the transverse

processes of as many caudal vertebræ; beyond, it is indistinguishable from the rest of the muscle.

Flexor lateralis.—The smaller of the two perfectly distinct caudal depressors is wholly ischio-coccygeal, arising definitely from the tuberosity of the ischium by a broad fleshy origin. It is a somewhat square, entirely fleshy plane proceeding obliquely outward and downward to be definitely inserted by about 3 digitations into the transverse processes of as many coccygeal vertebræ, just in advance of the origin of the caudo-tibial muscle.

Depressor caudæ.—The principal flexor of the tail is the largest of all, as well as the most complex in structure; and doubtless, to judge from the obliquity of its segregated fascicles, it subserves other movements of the member. It arises, first, inside the pelvis just behind the acetabulum, and at the junction of the haunch-bone with the sacrum; it may be said, further, to take continuous origin thence to the tip of the tail, from the apices and under surfaces of all the transverse processes. The fibres are very oblique; except at first, in fact, it may be regarded as a series of many such diagonal slips, partly blended together. The under surface is invested with an extremely dense glistening aponeurosis, made up of a number of obliquely set, overlapping or imbricated laminæ of fascia, each of which is the broad flattened tendon of a muscular fasciculus. These aponeuroses combined are the tendon of insertion of the muscle into the vertebral bodies from near the base to the extreme tip of the tail.

Besides the foregoing caudal muscles, there is a series of well developed intertransversales; and another set of smaller slips runs along the articular eminences. The tibio-caudal muscle, although attached to transverse processes, as it passes by them, extends to the median line of the tail underneath, by a thin, broad, flat tendon that lies external to the main flexor of the tail.

III. CERVICAL MUSCLES :— Superficial, and not connected with vertebræ or scapula.

Under this head will be noticed the sterno-mastoid and principal muscles of the hyoid apparatus. The first named is double on each side, unless one portion is "cleido-mastoid." The hyoid muscles exhibit a remarkable tendency to run together, both by lateral blending and by end-to-end joining, in several cases where among most animals they are distinct.

Sterno-mastoid.—The *superficial* portion is the larger: it arises by a short flattened tendon from —— ("the mastoid"—*Owen*; insertion destroyed), and forms a stout, somewhat flattened belly that descends obliquely inward, exactly parallel with, and contiguous to, the anterior border of the trapezius, to be inserted fleshy and by a

very short tendon, into the episternum, a little below and in front of the edge of the bar, on either side of the median line, in apposition with its fellow. It forms, as usual, the letter X with the omo-hyoid. The deep portion is much smaller; it has a separate but contiguous tendon of origin "from the mastoid," and in the neck lies directly beneath, and in apposition with, the other for its whole length. Though thus entirely covered, its course, particularly below, is a trifle oblique to that of the superficial portion, whereby it gains, at length, the outer border of the latter, becomes superficial, and is inserted into the border of the episternal bar, at junction of first and middle third, where the insertion of trapezius ends.

Hyoid Muscles.—The fleshy band that lies upon the wind-pipe is barely or not separable, without forcing the dissection, into right and left halves; there is no distinction whatever of a *sterno-thyroid* from *sterno-hyoid*; nor is a *thyro-hyoid* demonstrable. The common band of muscle arises inside the thorax on the median line, from the lower part of the inner surface of the manubrium sterni (not from the episternum), and runs uninterruptedly up the trachea to the larynx. The median part of the band is attached above to the thyroid cartilage, while the lateral portion passes up without attachment to be inserted into the side of the os hyoides, and especially into the enlargement of the greater cornu; this portion, moreover, appears continuous with *hyo-glossus*. In like manner *mylo-hyoid* and *omo-hyoid* are connected, if not continuous, at the hyoid bone; there is trace of a tendinous intersection, but the hyoid insertion (into the side of the body of the bone) of the two is identical, and some at least of the muscular fibres are not interrupted. The *mylo-hyoid* passes a little outward as it goes to the jaw, and is inserted fleshy upon the outside of the ramus, partly overlapping the latter, and being itself partly overlapped by a muscle to be presently noticed (*a*). There is no evident distinction of *genio-hyoid* from *genio-hyo-glossus*; though these are united (or separated, if the term be preferred) by a tendinous intersection; but the *genio-hyo-glossus*, on the other hand, is mostly distinct from the *hyo-glossus*. The *genio-hyoid* runs obliquely forward and spreads outward, partly in apposition with its fellow, to be inserted along the greater part of the ramus of the lower jaw, like the *mylo-hyoid*, instead of culminating at the symphysis menti. The *genio-hyo-glossus* forms as usual a vertical plane, in apposition with its fellow on the median line; behind, it has the ordinary attachment to the os hyoides, and is considerably blended with the *hyo-glossus*; its anterior connections are rather with the *genio-hyoid* than with the jaw itself. The *hyo-glossus* is the longest and most distinct muscle of the three, though continuous behind with the *sterno-hyoid*, as already stated; it forms a terete bundle on either side of the under surface of the tongue.

(a).—A small muscle somewhat resembling another mylo-hyoid, arises with its fellow from the hyoid on the median line, and proceeds forward and outward, spreading over the jaw at its narrowest part, to be inserted into the lower lip.

Another little muscle lies upon the outside of the ramus of the lower jaw, taking definite origin, fleshy, from the fossa at the end of the groove in the bone; it is distributed to the integument of the lip. Transverse fibres of the panniculus, and the muscle *a*, also contribute to the fleshiness of the part.

Other muscles of this region could not be dissected owing to the condition of the specimen.

IV. THORACIC MUSCLES proper.

These were not dissected.

V. ABDOMINAL MUSCLES.

The muscular walls of the belly conform to the usual marsupial type in the great size and fleshiness of the obliquus externus, extreme thinness and verticality of the obliquus internus, fleshiness of transversalis, thoracic prolongation of rectus, and extent of pyramidalis. They are chiefly noticeable for the absence of inguinal opening. The quadratus lumborum, often referred here, has been already considered.

Obliquus abdominis externus.—Arises by fleshy digitations from all the vertebral ribs except the two first—the first digitation being continuous with the lower slip from the *serratus magnus*; and separation into digitations becoming obsolete on the last 2-3 ribs; with origin also from lumbar fascia and tip of the ilium. The posterior border of the muscle presents a concavity towards the spine, the most distant point being at the middle of the thorax, about 8 inches from the vertebræ. Except at the extreme lower portion the muscle is fleshy, with the usual direction of its fibres; these continue as far forward as the outer border of the rectus. The insertion is aponeurotic into the whole linea alba, and symphysis pubis; and fleshy into whole length of marsupial bone, its upper edge; at the tip of the latter, there is also an aggregation of fleshy fibres of insertion. There is no arrangement for abdominal rings or 'pillars.'

Obliquus internus.—Extremely thin, and with some difficulty demonstrable from the *transversalis*, even in its muscular portions; but on holding the wall up to the light, the fibres may be distinctly seen decussating with those of the transversalis nearly at right angles. The aponeuroses of the two are blended and completely inseparable after passing beyond the tolerably well defined 'linea semilunaris,' where the muscular fibres of both end. The fleshy part arises mostly, if not wholly, from the iliac extremity, and passes upward with little,

If any, obliquity, terminating at the broad oval cartilages of the floating ribs, as high up, at least, as the 10th from the last.

Transversalis.—Larger and better defined than the last; arising from the whole lower margin of the thorax, internal to the oval cartilages, by slips interdigitating with the diaphragm, from the xiphoid cartilage to the last rib, and thence from the innermost lumbar fascial septum (and so from transverse processes of vertebræ) to the apex of the ilium. The muscle is thickest above, where some fibres reach quite to the linea alba, for 3–4 inches below the xiphoid; further down these cease at the linea semilunaris in the broad thin aponeurosis of median insertion common to this muscle and the foregoing. All the muscular fibres are directly transverse.

Rectus abdominis (internus).—Is thoracic as well as abdominal—a long continuous ribbon from episternum to pubes. It arises fleshy at a point at the top of the thorax where epicoracoid, coracoid, episternum, manubrium and first rib meet, taking attachment from all these bones, and also slightly from the next rib as it passes down. On the thorax it rests a little on the sternum, but mostly lies along the ends of the ribs, overlaid by the pectoralis major, and crossed at bottom of the sternum by the obliquus abdominis (some of the fibres of which appear to blend with the outer border of the rectus without reaching the median line). The abdominal portion is a little wider and thinner, in apposition with its fellow along the linea alba, separated from the obliquus externus by interposition of the pyramidalis, and lying wholly exterior to the conjoined aponeurosis of obliquus internus and transversalis—these not forming a sheath below, as in man. The insertion is into symphysis pubis and brim of that bone as far outward as the termination of the articulation of the ossa marsupii. There are no 'lineæ tendineæ transversæ.'

Pyramidalis, s. Rectus externus.—Of great length; and broad at base, in consequence of the outward divergence of the marsupial bones, from the whole length of which (their anterior border), and from the symphysis, the muscle arises. The outer border represents a line from the tip of the marsupial bones to the xiphoid; the inner corresponds to the linea alba. The lowermost fibres are almost directly transverse; the others become successively less oblique to the axis of the body, and finally are nearly longitudinal; the muscle runs to a point above, and is fleshy throughout. It approximates and appresses the marsupial bones, counteracting the obliquus externus, which divaricates them. It is thus in indirect subservience to the reproductive process, in an early state of the young; and similarly, the thoracic prolongation of the rectus internus furthers the bending of the animal in voluntary self-assistance during parturition and subsequent care of the young, as in ordinary marsupials.

VI. PERINEAL MUSCLES.

Not dissected.

VII. MUSCLES CONNECTING THE SHOULDER-GIRDLE WITH THE BODY.

Of the several muscles connecting the scapular arch with the body, the deep portion of the sterno-mastoid, which is really essentially clavicular in its insertion, has been already considered. The omo-hyoid, as usual, forms the direct muscular band between the hæmal arches of consecutive cranial vertebræ, in this repeating an ordinary intercostal. The others are in three sets, arising from *a*, spinous processes of vertebræ along the median line, *b*, processes of cervical vertebræ along the side of the neck, and *c*, from the thorax. Trapezius is in two parts, one of which is thoracic, while rhomboideus is single; the cervico-scapular plane, answering to 'levator anguli scapulæ,' is double; besides which, there are, as in ordinary marsupials, two perfectly distinct atlanto-scapular levators. The costo-scapular plane (*serratus*) is small and slight, and differs from that of some (all?) marsupials in being entirely distinct from levator anguli proper; there are also other thoracic muscles passing to the shoulder apparatus. As a whole, the scapular arch is much less mobile than usual, in consequence mainly of the episternal attachment and coraco-sternal articulation.

Omo-hyoid.—As already stated, continuous with the mylo-hyoid, at its hyoid point of insertion; and there is no division into two bellies by a tendinous intersection, nor any confining of the muscle in its continuity by an aponeurotic pulley. Above it is partly divisible into two fasciculi, the smaller internal one of which is inserted lower down on the hyoid than the other, and is distinct from mylo-hyoid. The muscle forms a single flat ribbon, at first descending nearly straight down the neck, then passing obliquely outward, crossing behind the s.-mastoid, between this and levator anguli scapulæ, and dipping beneath the episternal bar, to be finally inserted on the scapula, partly fleshy and partly tendinous, just below the acromion, in a notch half way between clavicular and humeral articulations. The ordinary action.

Trapezius.—Large; distinct from deltoid, as in clavicate animals generally, and further resolved into two entirely distinct portions, as if by disappearance from the back between and in advance of the shoulders, of the part corresponding to the aponeurotic space of the human subject. The *anterior part* arises from the occiput (precise limits of origin not visible in the specimen), and thence down the median line of the neck, by an aponeurosis common to it and its fellow, with only secondary connection with cervical spines, to a point opposite the most prominent part of the scapula, to which the lower border

of the muscle runs transversely; the anterior border folds around the side of the neck parallel and in apposition with the s.-mastoid; the insertion is partly fleshy, partly tendinous, into the scapular spine, and border of episternal bar, as far to the front as the insertion of the deep s.-mastoid. The posterior part arises from the 10th–11th ribs by two fleshy digitations situate respectively 1' and 1½' from the back-bone, and from a broad, oval, dorsal aponeurosis common to it and its fellow. The muscle has the form of a narrow scalene triangle: its lower border approaches the spine about the middle of the back, and is there contiguous with its fellow; the anterior border passes straight up the side of the chest, lying upon the latissimus, past the back of the arm; the acute apex is inserted by a very short, thick tendon into the end of the scapular spine, in connection with the posterior corner of the insertion of the anterior trapezius, and of the deltoid behind — the latter curving down in front of the arm, which is thus set in a deep recess betwixt these two muscles. Under this portion of the trapezius, in the deep hollow of the back between the shoulders, the large gland lies embedded in copious lax areolar tissue. When the two parts of the trapezius act together the effect is much the same as if they were not disjoined; the special effect of their dis-sentaneous action, if they have such, is not so evident.

Rhomboides.—Single; of large size, and thick. It arises in apposition with its fellow along the median line of the neck behind (disposition above, and cranial attachment, if any, not seen); the lower border passes transversely to the scapula, and a little downward; the insertion, broad and fleshy, is into the apex behind, and about ½' along the posterior border of, the scapula. Has the usual action.

Costo-scapularis; *serratus magnus s. anticus*.—Perfectly distinct from the cervico-scapular plane, from which it is separated by a triangular interval an inch wide in front, narrowing behind as the two muscles mutually approach towards the apex of the scapula. The muscle is unusually small, consisting of only three short digitations from 1st–3d ribs, rapidly lengthening from first to third, the last almost perfectly continuous with the first slip from the obliquus abdominis; the three fascicles remain distinct near to their insertion, which is by a short terete tendon into the very tip of the scapula. Has the usual action.

Pectoralis minor?—Besides the serratus, another plane of muscle connects the shoulder apparatus with the top of the thorax; it has somewhat the situation and relations of an 'intercostal' betwixt first rib and the bones above. It is divisible into two parts. One of these, costo-coracoid, is larger and thicker than the other; it arises from the first rib, from the origin of the serratus magnus slip to the sternal articulation, and is inserted mainly into the base and inner surface of the coracoid. A smaller, thinner plane, manubrio-epicoracoid.

expands upon the internal surface of the epicoracoid plate. The first of these may be pectoralis minor; the second, subclavius?

The cervico-scapular attachments are several, and rather complicated. We have, first, two distinct muscles, both arising from the spur of the atlas hypapophysis, but with separate scapular attachments; each of these is a single belly. Then there are two planes of digitate muscles, each arising from several cervical processes, and with different scapular insertions. These last probably represent duplicate levatores anguli scapulæ proprii; while the two first named (also occurring in marsupials and other animals) are "protractores scapulæ."

"*Atlanto-acromialis*."—A single thick stout muscle, lying superficial and somewhat to the front, as well as on the side, of the neck, nearly parallel with the omo-hyoid, crossed above by the sterno-mastoid, and overlaid by the trapezius. With the tendinous origin above mentioned (hypapophysial process of atlas) it soon swells to a large belly, and is inserted fleshy into the antero-interior aspect of the scapular crest, and thence in a line behind the episternal articulation as far as the insertion of the omo-hyoid. It draws the shoulder-blade towards the head, and a little to the front.

"*Atlanto-scapularis*."—Origin with the preceding, and in like manner; and overlaid by it in the upper part of its course. It passes a little more obliquely as it descends, lying upon the deeper muscles of the back of the neck. It has somewhat the appearance of an enlarged and distinct fasciculus of levator proper, with which it is inserted, fleshy, into the antero-internal surface and upper border of the scapula near its apex. Action nearly the same as that of the foregoing, but more oblique.

Levatores anguli scapulæ.—A double plane, with common digitate origins, but separate insertions. Each numbers about 6 slips of origin from the transverse processes of the first dorsal and all the cervical vertebræ except the atlas and axis; the slips are separable nearly to their insertion. The posterior, or internal plane lies directly upon the muscles of the back of the neck; it is quite flat, fan-shaped, and converges from its broad origin to be inserted fleshy, into the posterior extremity of the scapula, from the apex one-half inch up the blade. The digitations are all terete, and lie in the same plane. The other muscle lies anterior to the last; its digitations are broader and flatter, enlarge as they pass to the scapula, and are packed obliquely against each other. The lowermost slip does not reach the scapula, ending in tendinous insertion into the next above; the other five have fleshy insertion into the antero-internal surface of the bone, chiefly on a line near the edge of the crista. The action of both planes is much the same; they draw the bone around to the front and upwards, rotating it a little.

VIII. MUSCLES OF THE ANTERIOR EXTREMITY.

The arrangement indicated in the beginning seems to us fully as convenient as, and much more natural than, grouping the muscles of the limbs upon, and naming the several sets after, the parts upon which they lie, instead of those on which they act.

The humerus, like that of the mole, an animal which uses its forelimbs in corresponding manner, is short, thick and extremely irregular in superficies, with strong elevations and depressions for advantageous arrangement of the muscles. The bone may be regarded as a knotty osseous nodule interposed between shoulder and elbow-joint for the strong movement of the forearm in several directions; itself moving through little space, but capable of being very powerfully pulled in every direction, and thus laying the foundation, as it were, for the various strong movements of the forearm. It is acted upon, from the body, by the dermo-brachial slip already described, and by the two following muscles:—

a. *Acting upon the humerus.*

(a'. — From the body.)

Latissimus dorsi. — Notable for its extensive costal, and correspondingly slight spinal, origin. It arises by aponeurosis from about 6 dorsal vertebræ (4th–9th), beginning above at a point just opposite the shoulder, to which, therefore, the upper border passes directly transverse; most of this spinal portion is thicker than the costal. The latter origin is by a series of fleshy slips from the 7th to the 14th ribs, in a slightly irregular curved line the convexity of which is forward; the digitations are separable for some distance, especially the few lower ones. No aponeurosis connects this costal with the spinal portion; such fascia having apparently been appropriated by the lower trapezius and costal slip of panniculus, already described. The lower, outer border of the muscle ascends very obliquely; before insertion, there is a complete twist, as usual, the upper fibres becoming lower by twisting *outwards*; and conversely. Insertion by a short, wide, thin, flat tendon in an oblique line upon the humerus, half-way up the pectoral crest, and thence along the entocondylar ridge to the elbow. The muscle has its ordinary action, very advantageously effected by its extensive and low insertion.

Pectoralis major. — Of remarkable extent. Its origin is in a line from the acromion and whole episternal bar, and thence down the manubrium and sternum and linea alba to within a couple of inches of the pubes. Along the front of the chest it has thick fleshy origin from the ends of the ribs as well as from the breast bone. The abdominal portion is extremely thin—thinner than the same part of the panniculus; the muscle thickens rather abruptly as it passes over the lower

edge of the thorax, and there, near the median line, a slight cellular interval may occur between thoracic and abdominal portions. The chest portion is of nearly uniform, and great thickness; there is no evident distinction of a deep-seated from a superficial part; but the outer half of the episternal portion and the acromial portion are together * separable from the sternal portion, by a slight cellular interval along a line representing the posterior border of the muscle below described as the anterior part of the deltoid. (This last named muscle is crossed at right angles, overlaid, and mostly hidden by the pectoralis.) The rather thin outer border of the pectoralis is nearly in a straight line from the symphysis pubis to the shoulder; the thoracic part of this border lies nearly parallel with the anterior border of the obliquus abdominis. The thick convex anterior border dips down over the posterior border of the deltoid to the humerus. All the fibres of this great muscle converge *without twisting* to an extensive linear insertion by a short stout tendon into the pectoral ridge of the humerus. The acromio-episternal bundle of fibres is set in much lower down than the others, from which they are virtually separated by the insertion of the slip from the panniculus. The pectoralis has the usual action, carried to a high degree; it is also, owing to the great development of the pectoral crest, an unusually powerful rotator of the humerus, an action in which the latissimus assists. The purpose here subserved is evident on reflection upon the way the paddle-like hands should strike the water when the whole arm is *forcibly extended* in giving the backward stroke.

(b. — From the scapular arch.)

Deltoid. — (According to high authority, the deltoid is double, and the two muscles about to be described may constitute its two halves; but the anterior of these, which is overlaid and covered by the pectoralis, would hardly recall a deltoid by any physical feature.) The posterior part is of pyramidal shape, with thick fleshy origin from the most anterior (highest) part of the scapula, and a low insertion on the humeral crest by a rather long tendon. Some of its fibres of origin appear almost continuous with those of the posterior trapezius; while it is almost blended with the pectoralis at its insertion. The anterior portion lies upon the epicoracoid plate, conforming

* These portions together are in the ordinary position, and have much the appearance, of a deltoid — in fact, they resemble one much more than the muscle, below described as “anterior deltoid,” does. We are in doubt of the accuracy of our identification of the muscle we describe as anterior portion of the deltoid, but can come to no more satisfactory conclusion, without identification of what is described in a preceding paragraph as “Subclavius? Pectoralis minor?” — a determination that we cannot at present make. One of the inner pectorals of birds may furnish the clue.

in contour with the latter; fleshy fibres take origin from the whole surface of that bone. The muscle narrows and curves a little as it passes down, directly overlying the shoulder-joint, and in relation anteriorly with the long epicoracoid head of the biceps, to be inserted fleshy into the most prominent part of the pectoral crest of the humerus, above the insertion of the posterior deltoid. When these two muscles act together, they would have the usual effect in elevating, or abducting, the humerus; acting separately, they have little of this effect, but are respectively extensors and flexors of the bone, with a slight rotating power in opposite directions.

Independently of the foregoing, there are the usual number of scapulo-humeral muscles; but owing to the singular shape of the shoulder-blade, position of its faces, and other causes, it becomes somewhat of a question what names are to be applied to them. We describe them accurately, and if mistaken in identification there will be no trouble in rectifying the error. We determine subscapularis, both spinati, no teres minor, and double teres major, making five in all, as usual.

Supraspinatus.—A slender, straight fascicle, much the smallest of the three that more especially occupy the shoulder-blade. It arises fleshy in the depression between the most prominent point of the scapula and the glenoid—that is, about half-way betwixt these two points, and partly around on the antero-internal aspect of the bone (owing to the reflexion of the latter), close by the insertion of the omo-hyoid; it passes straight to the joint, which it directly overlies, and is inserted by a short, flat tendon into the anterior tubercle at the head of the bone, just opposite the proximal beginning of the insertion of the epicoracoid part of the coraco-brachialis. It rotates the humerus outward, as usual directly opposing the subscapularis.

Infraspinatus (and teres minor? or the latter wanting?).—Largest of the three. Occupies, and arises fleshy from, the whole of the scapular plate below the spinous elevation, that is, between the last named and the origin of the scapular head of the triceps; narrowly fan-shaped and slightly curving, to be inserted, partly fleshy and partly tendinous (tendon superior and muscular part infero-external), into the posterior aspect of upper part of pectoral crest, just below insertion of the preceding, which it powerfully aids in rotating the humerus outward.

Subscapularis.—This is in what would be for most animals the usual position of “*Infraspinatus*,” and might be taken for the latter, were it not for its widely distant insertion into the other side of the head of the humerus. A rather small subterete fascicle, arising fleshy from that part of the scapula which lies between the glenoid and head of the triceps extensor brachii; crossing to the shoulder-

joint behind to be inserted, chiefly fleshy, into the posterior tubercle upon the head of the humerus. It rotates the bone inwards, feebly counteracting the two preceding muscles.

Teres major. — Double; both portions of great size, and perfectly distinct. The *lower*, or teres major proper, arises fleshy from the posterior extremity of the scapula for about one-third of an inch; it lies at first upon the serratus magnus, and then along the superior border of the latissimus, forming a great pyramidal muscle running between the last and the upper teres, rapidly narrowing to a rather long, stout, flattish tendon that passes behind (mesial of) the scapular head of the triceps, to be inserted in the posterior ridge of the humerus, one-half inch or more above the insertion of the latissimus. On its deep surface muscular fibres reach nearly to its insertion; on the superficial aspect, the large glistening tendon radiates nearly half way to origin. The *upper* portion is still larger, and has more extensive and complicated origin from both "sides" of the scapula, which is thus, as it were, embraced by the muscle. The outer origin is from the postero-external aspect of the scapula, from the origin of the lower teres to that of the scapular head of the triceps; the inner origin is thinner and more extensive and fleshy, from the whole surface of bone between the insertions of the two digitate sets of levatores scapulae. The muscle is pyramidal in shape, like, and with the general aspect of, the preceding, and with precisely similar tendinous arrangement. But it is inserted much higher up, in immediate relation with the shoulder-joint, into the posterior tubercle of the humerus, alongside the insertion of the muscle above called subscapularis. N. B. Its tendon contains an articular sesamoid bone.

Two perfectly distinct muscles besides the one above called "anterior deltoid" proceed from the coracoid apparatus to the humerus; they have together been considered as coraco-brachialis, but the name is properly applicable to only one of them.

Coraco-brachialis proper. — This is the posterior, and the longer and slenderer of the two. It arises by a very short tendon in common with the larger moiety of the *biceps*, from the sternal extremity of the coracoid; quickly enlarges to form a flattened-fusiform muscular belly, representing the postero-internal margin of the arm; it is overlaid by the greater moiety of the *biceps*, itself overlying at first, the muscle next below described, and afterwards the tendon of the *latissimus*, which it crosses at right angles. Its insertion is fleshy and with a very short tendon, into the lower part of the entocondylar ridge of the humerus, nearly opposite the foramen: its outer surface of insertion is in relation with the pronator radii teres.

Epicoraco-brachialis. — Much larger than the other, and with different origin, course, relations and insertion; lying partly upon and

partly under, the whole coracoid apparatus, and upon the posterior aspect of the proximal moiety of the humerus. Viewed at first from the outside, superficially, it appears to arise from coracoid proper, and to descend thence upon the humerus. But its real origin is much more extensive, from the whole, or nearly all, of the under (internal) surface of the epicoracoid lamella, as a thin expanded plane, whose contour is determined by that of the bony plate just named. It gains the outside by curving around the coracoid proper, reminding one of the escape of the iliacus over the pelvic brim, or of obliurator internus over the border of the ischium. It has a broad fleshy insertion into the expanded surface of the humerus, upon the aspect of that bone above noted, as far down as the insertion of the latissimus. These coraco-humeral muscles adduct and retroduct the arm, bringing it upon the breast, as in the act of clasping; and have furthermore somewhat the action of internal rotators of the bone.

This extensive and somewhat complicated disposition of the coraco-brachial muscles, and their perfect differentiation into two, are in striking contrast with the singularly small and simple condition of the (single) muscle in some animals of the next order above, as the opossum for instance. It is the nearest approach of which we are aware, to the ordinary condition of the antitypic muscles of the hind limb, which are always differentiated into several adductores femoris.

b. Acting upon forearm.

Only one forearm muscle comes from the body: it is the slip from the latissimus. Of the other "long" brachial muscles, the biceps is doubled above, and has a singular disposition; the scapular head of the triceps ("long" extensor cubiti) is entirely discrete from both the other ("short" extensors) heads, for a reason we disclose below. The brachialis anticus ("short" flexor cubiti) is not remarkable. Perhaps the most interesting point regarding the muscles of this part is the remarkable development of the anconæus, and the presence of another antagonistic anconæus, both in subserviency to the peculiar motion that the elbow-joint permits in lieu of pronation. The pronator teres—that very constant muscle in higher vertebrates—is present under ordinary conditions, although there is no pronation possible in the forearm; so also are the two supinators (but the pronator quadratus is wanting?).

Before proceeding to consider the muscles that act upon the forearm, we may notice the method of adapting the whole limb for use as a paddle. The humerus, as we have already seen, is extremely short and thick, and is especially broad across the condyles, where the width is but little less than its whole length. We have also seen that the principal muscles that extend, *i. e.*, retroduct, the humerus,

in the act of giving the stroke to propel the body through the water, are so inserted as to have a strongly rotating effect upon the bone, twisting the limb in such a manner as to throw the elbow up and away from the body. Now the two bones of the forearm are in mutual apposition for their whole length, and so closely bound, that relative motion upon each other is abrogated; the forearm is confined permanently in a state of semi-pronation. But it is evident that the broad surface of the webbed hand must strike the water in the backward stroke, and that the thin edge of the palm must cleave the water in the bringing forward of the member; that is, there must be perfect virtual pronation and supination during each stroke and return to position for the next one. With the forearm bones stiffly bound together to ensure strength and fixity of the wrist and hand, this requisite rotation of the forearm and change through 180° of the plane of the webs is effected by the construction of the elbow-joint, and disposition of the muscles that act from the humerus and scapular arch upon the proximal end of the forearm. The elbow, instead of being the most strict ginglymus in the body, as usual among mammals, is largely amphiarthrodial, permitting free rotation or lateral rocking of the forearm upon the humerus. This compound motion seems to be very nearly like what would occur as a resultant if, in man for instance, the rotation of the head of the radius in its ulnar socket should enter as a component of, and be merged into, the to-and-fro swinging of the forearm upon the humerus. In a word, the animal *feathers its oars at the elbow-joint* — not at the wrist.

In studying the action of the several muscles concerned, we see clearly how this is effected and find the reason for certain peculiarities in their disposition. We have only to add further, in this connection, that the articular facet of the humerus is not directly at the end of the main axis of the bone, but displaced to one side, so as to be at the base of the immensely developed ectocondylar process; that both the widely divaricating condylar processes offer salient *points-d'appui* for the muscular tractions that rotate the forearm; and that the olecranon is a very broad plate curving far up behind the humerus, with widely expanded corners, in subserviency to the varied action of different parts of the triceps and anconæal muscles.

(a'. — From the body.)

Dorso-epitrochlearis. — The forearm slip from the latissimus is well developed. It is given off obliquely from the lower border of the muscle, a little more than an inch from its humeral insertion, and mounts upon the back of the forearm, crossing the limb over the most prominent ridge of the latter. It appears to end in fascia over the middle of the back of the forearm; but may be traced, without unduly forcing the dissection, to pretty definite insertion into the

ulna itself, at about the middle of the bone. The slip is of a nearly uniform width of about a third of an inch, and is thin and flat; it has the usual action.

(b'. — From scapular arch; "long.")

Biceps. — The coraco-radial flexor is in two parts, with rather unusual disposition; one of the "heads" is much larger than the other, and the two arise far apart; but they are implanted together upon the radius. The anterior part — *epicoraco-radialis* — arises fleshy high up on the epicoracoid plate from its border and postero-interior moiety, where it is overlaid by the episternum, and soon forms a slender terete fascicle, which passes outward in relation with the origin of the rectus abdominis, subsequently overlies the anterior portion of the coraco-brachialis, and then comes in relation of contiguity with the other moiety of the biceps, which it separates from the pectoral crista humeri. Passing this last, it changes to a long terete tendon that represents the anterior border of the biceps where this dips betwixt the forearm muscles. The posterior and larger part — *coraco-radialis* — arises from the sternal extremity of the coracoid in common with one head of the coraco-brachialis, and immediately swells into a great, broad, flattish, fleshy belly that passes down the arm lying a little obliquely upon both the coraco-brachiales, and subsequently upon the tendon of the latissimus dorsi. It becomes penniform by insertion into the tendon of the other head of the biceps; posteriorly, the muscular fibres nearly reach the radius. The common insertion of the two is by a broad flat tendon into the middle third of the radius.

(The other (ulnar) flexor cubiti is noticed under the next head, c').

Triceps, its long head. *Rectus humeri* ! — The "long" or scapulo-ulnar extensor of the forearm is remarkably distinct from the two humeral, or "short" heads. It arises fleshy from the posterior concave border of the scapula, from the glenoid an inch or so backward. It is thus a rather thin broad plane, that passes between and separates the two teretes majores (see above) from the other scapulo-humeral muscles; as it descends the back of the arm, it narrows in one transverse direction, and thickens in the other, so that here its greatest diameter is at right angles with the same diameter above. The anterior (glenoid) edge of the muscle is at first in apposition with the posterior surface of the brachialis internus; after the above mentioned change in the long diameter of the muscle, its broad flat surface is similarly applied to the equally expanded surface of the brachialis internus. In place of the tendinous inscriptions that commonly unite this scapular head below with both the humeral heads, we have them separated by cellular intervals. Neither is there an aponeurotic investment of the muscle below; but it has a wholly fleshy, thin,

broad from side to side, insertion with the remarkably wide posterior border of the olecranon.

(c'.—From the humerus; "short.")

Triceps, its internal head. *Vastus internus humeri*!—This muscle is of large size, and wholly distinct from the foregoing; it is not divisible into fasciculi. It is fleshy throughout, and of a somewhat pyramidal shape, being broadest below. It lies almost directly posterior upon the humerus, and fills up what would otherwise be a great fossa between the head of the humerus and the olecranon. Its relations are—behind, to the scapular head of the triceps, which is applied flat to its whole surface; in front, mostly to the humerus itself, but also in greater or less part to the brachialis anticus, origins of both inner and outer bundles of forearm muscles, and to the muscle below described as *antanconæus*; to the outer side, to external head of triceps; to the inner side, to lower part of brachialis anticus, and tendon of latissimus. It takes fleshy origin from the whole of the upper half of the back of the humerus, and is inserted fleshy into the whole width of the edge of the olecranon. At the innermost point, some fibres are collected into a slightly separable bundle, which has more especial and partly isolated insertion into the inner corner of the olecranon.

Triceps, its external head. *Vastus externus humeri*!—Like both the foregoing, entirely distinct, and remarkable for its comparatively small size, its isolation from the humerus in its continuity, its definite tendinous origin and insertion, and peculiar, independent action. The muscle is fusiform in general shape, but somewhat prismatic in a transverse section; it lies entirely away from the humerus, upon the outer aspect of the arm, in a bed formed between the brachialis anticus and inner head of triceps. It arises by two tendons; one is a narrow, flat, strong band from a recess behind the "greater tuberosity" of the humerus; the other a broader, shorter, more diffuse and aponeurotic-like fascia from what would be "neck" of an ordinary humerus. It is inserted by a short, definite tendon into the extreme outer corner of the transversely expanded olecranon.

This last division of the triceps, while extending the forearm like the other two, more especially pulls upon the outer corner of the olecranon, and tips it up sideways, thus producing (in connection with the *anconæus*) the remarkable rotation of the forearm that answers instead of pronation. The inner head has the reverse action less plainly marked, while the scapular head is the direct extensor; but both these two last have so broad a fleshy insertion into the olecranon, that if they contract unequally in their different parts, they may have corresponding effect in tipping the olecranon sideways. The several actions of the triceps, as a whole, are furthered by the follow-

ing muscles—one of which is an immensely developed anconæus, and the other its peculiar antagonist:—

Anconæus.—Of remarkable size and partly divisible into two portions. One of these occupies the lowest part of the humerus behind, somewhat in the position of what is called *subanconæus* in anthropotomy; it lies beneath the internal head of the triceps, filling the fossa between the olecranon and the humerus below, arising from all the broad depression between the two condylar ridges. It is triangular in outline, but really tetrahedral in shape, and entirely fleshy. Its fibres pass downward, backward, and very obliquely outward, directly over the back of the elbow-joint, to be inserted into the whole of the superior surface of the olecranon; but some are continuous with the other part of the muscle, or *anconæus* proper, passing for this purpose through the deep notch between the ectocondyle and the outer angle of the olecranon. The superficial portion of the muscle, however, has pretty distinct origin from the ectocondyle, and thence spreads out fan-shaped, to be inserted fleshy into the whole outer and back surface of the ulna as far along as the origin of the *abductor pollicis longus* (except just along the edge and at the tip of the bone, which are reserved for origin of *extensor carpi ulnaris*). The attachments and oblique traction of this muscle make it a powerful rotator of the forearm upon the humerus, as well as an extensor. It is opposed by

Antanconæus.—A muscle of considerable size that lies very obliquely across the *inner* side of the back of the elbow. It arises from the tip of the entocondyle in connection with the pronator and carpal “flexors,” and immediately forms a thick, bulging fleshy belly that rather suddenly contracts to a short, stout, rounded tendon to be definitely inserted into the prominent tubercle at the inner corner of the olecranon. The muscle lies mostly upon the expanded inner condyle and fills up what would otherwise be an hiatus between the inner head of the triceps below and the ulnar head of the “flexor” *carpi ulnaris*. It subserves the rotary motion of the forearm, as well as extends the latter; producing a movement corresponding to supination, and thus directly counteracting the foregoing.

Brachialis anticus.—(*Flexor cubiti ulnaris*.) Returning now to the flexor set, we find that the “short” or humero-ulnar flexor of the forearm is large and lies rather outside, than in front, of the humerus, in consequence of the singular shape of that bone; it only gains the front more than half way down, and runs up the outside of the bone nearly to the shoulder-joint. Arises, fleshy, from all the depressed space between the great pectoral crest and the prominent ectocondylar ridge; it is overlaid, above, by the external head of the triceps. Becoming anterior, at length, between the condyles, it dips down between the widely separated bundles of forearm-muscles, and narrows

by lateral flattening to be inserted tendinous into the ulna, along the radial edge of that bone from scarcely beyond the elbow-joint half way to the wrist (there being no coronoid process for its definite insertion).

Thus the two flexors of the forearm, ulnar and radial—inner and outer—preserve ordinary relations in the forearm; the biceps not splitting below to have part of its insertion into the ulna, as in certain marsupials. There are only two other muscles that act upon the forearm, viz.: the round pronator and short supinator; for the square pronator is absent, and the long supinator, as usual among mammals, is a humero-carpal muscle. The arrestation of this muscle on its way to the carpus and its insertion into the styloid process of the radius, is a teleological modification only found among the very highest mammals.

Pronator radii teres.—Although the forearm is fixed in semi-pronation, this constant muscle is well developed. It is not, however, superficial, and so determining the contour of the part, nor does it arise first or highest up on the entocondyle, but it is deep-seated, and overlaid in greatest part by the "*flexor*" *carpi radialis*. It is a single terete subfusiform belly, with origin from the entocondyle next below the last named muscle, passing obliquely to be inserted into the middle third of the radius by a rather long, flat tendon, in relation, on its radial aspect, with the tendons of biceps and brachialis anticus. Its function is limited to steadying of the parts.

Supinator brevis.—A deep-seated, triangular plane of moderate size; its outer, free border stretches in a straight line between the tip of the ectocondyle and the middle of the radius, and the body of the muscle fills the depression between these points. It has no ulnar origin; but arises from the anterior border and tip of the ectocondyle, and has definite, fleshy insertion into the upper half of the radius—ending just in advance of a point opposite the insertion of the pronator teres. It counteracts this last, but its action must be very limited.

c. Acting upon carpo-metacarpus, from humerus or forearm.

The contour of the forearm is that of a flattened flask, broad above, and rather suddenly contracting to a narrow neck towards the wrist. Above, the fleshy bundles are widely separated, by the whole distance between the tips of the expanded condyles of the humerus; they are thick and bulging, which may be said also of the muscles upon its back. As usual, the aggregate bulk of the muscles upon the front is greater than that of those upon the back; but the latter are more numerous. The disposition of the muscles is simple, compared with that of most higher ungulates, and there are several notable absences, as will be stated further on.

Before noticing the individual muscles that act upon the wrist, we should explain the necessity of changing the names of the so-called flexors and extensors. The morphological position of the forearm is with the bones uncrossed in strong supination. Then the palm looks *forward* and downward, with the nails uppermost and pointing *backward*; and in this position the hand is "symmetrical" with the foot, the sole of which looks *backward* and downward, with the nails pointing forward and upward. "Flexion" of a segment is its bending in the contrary direction to that of the segment above; as all admit in the case of the foot, where "flexion" is decreasing the angle formed between the front of the leg and the instep; but the fact has been strangely overlooked by most anatomists in the case of the hand, where apparently its customary pronation has deceived them. "Flexion" of the hand is the bending of that segment in the direction opposite to flexion of the forearm: that is, *backward*, remembering the supine position of the member. The muscles that do this lie upon the back of the forearm and hand, and correspond to those upon the front of the leg and instep; they are those called in anthropotomy the "extensors," but their function is *flexion*. We restore their proper name, and similarly call the "flexors" of anthropotomists, lying upon the front of the forearm, by their proper name of *extensors*.* There is to be no change in the digital flexors and extensors.

The *extensors* (i. e., "flexors" of anthropotomy) of the wrist are only two, ulnar and radial; both of large size.

Extensor carpi radialis. — The first muscle on the ulnar side of the pronator, interposed between this and the flexor digitorum communis; large, and of singularly flattened shape from side to side; very broad above, rather abruptly contracting to a very short and stout tendon. It arises both fleshy and tendinous from the tip of the entocodyle, and thence in a line across the bottom of the humerus in front (dipping into the deep fossa there found) to the radial articulation; and slightly from the head of the radius itself. The tendon, barely one-third of an inch long, mounts a little way up the radial border of the muscle: it is inserted by expanding upon and grasping, as it were, the most prominent carpal bone upon the radial border of the wrist. The usual action.

* Consult further in this connection—

BURT G. WILDER, *On Morphology and Teleology, especially in the limbs of Mammalia*. Mem. Bost. Soc. Nat. Hist., Vol. I. 1865.

JEFFRIES WYMAN, *On Symmetry and Homology in Limbs*. Proc. Bost. Soc. Nat. Hist., p. 277. 1867.

ELLIOTT COUES, *Antero-posterior Symmetry, with special reference to the Muscles of the Limbs*. New York Medical Record. July. 1870, et seqq.; pp. 149-152, 193-195, 222-224, 272-274, 297-299, 370-372, 390-391, 438-440.

Extensor carpi ulnaris. — Of very remarkable size, and bicipital above; whence those who believe in the "serial" homology of the muscles of the limbs might be led to infer that it is the homologue of the *gastrocnemius*. Its two separate portions above both lie flat and superficial; the outer determines the contour of the forearm at the part, the inner is appressed in its whole extent against the flexor digitorum, from which it is separated by a slight cellular interval. The larger (*ulnar*) portion arises fleshy from the very edge of the ulna, its upper three-fourths, and still more extensively from the edge, tip, and outer face of the olecranon; it is flattened-ovate in shape, and has an upper free edge that traverses across the notch between the inner corner of the olecranon and tip of entocondyle, where it is in relation with the "antanconæus." The smaller (*humeral*) portion takes origin from the whole length of the base of the entocondyle. These two parts only fuse just before changing into the stout tendon common to both; the ulnar portion overlaps the condylar. The tendon is longer than that of the extensor carpi radialis; it expands as usual to embrace the pisiform bone. The usual action.

Upon the back of the forearm there are three wrist *flexors* (i. e., "extensors" of anthropotomy); one upon the ulnar side as usual, and only two upon the radial, instead of three (the number when the "supinator longus" is, as it should be, enumerated with this set). Of these two radial flexors the humeral origins and general arrangement at first favor the supposition that they are the "longior" and "brevior" of anthropotomy, and that there is no supinator longus; but the much more important indication afforded by their insertions below determines pretty conclusively, that one of them is supinator longus, and that either the other represents combined longior and brevior, or that one of these last is missing.

Supinator longus. — Here seen in its usual character as a humero-carpal, not humero-radial, muscle. Above, it occupies somewhat the position of the flexor carpi radialis brevior, being shorter than, and wholly overlaid by, the other radial flexor. It arises fleshy from the anterior aspect of the external condyle, below the origin of the following muscle, lying at first upon the humerus and head of the radius, and then upon the supinator brevis; finally, upon the back of the radius; when, becoming tendinous, it passes by the expanded foot of the radius, and is immediately inserted into the *carpus*, its radial side. It is a pure flexor carpi.

Flexor carpi radialis (longior or brevior, or more probably both?). — Rather the largest muscle of the parts, and wholly superficial, overlying both the supinators; apposed externally against extensor digitorum, and on the other side in relation with brachialis anticus and biceps. It arises fleshy from the ectocondylar ridge, from the tip up-

ward for one-third of an inch; becomes tendinous about the middle of the forearm, passes behind the foot of the radius and over the insertion of supinator longus, to spread into a broad fascial tendon, by which it is finally inserted into the bases of the 2d, 3d and 4th metacarpals. From its very high origin upon the humerus, this muscle is the principal *passive* or indirect flexor of the hand when the forearm is extended.

Flexor carpi ulnaris. — While all the other muscles lying upon the forearm, are in greater or less part condylar in origin, this arises wholly from the ulna. It is a flat muscle, lying superficial upon the ulna behind; its posterior border corresponding to the edge of the bone and arising therefrom in greatest part, but also having extensive olecranon origin. It becomes tendinous near the wrist, and is inserted into the base of the 5th metacarpal, partaking somewhat of the general tendency to aponeurotic expansion that characterizes all the tendons coming down upon the back of the hand. As somewhat of a corollary of the last statement, it may be here observed, that the tendons along the back of the wrist and hand are pressed close to the bones, while those upon the front of the wrist and the palm are away from the bones, and are separated by deep distinct interstices of areolar tissue containing much fat.

The other muscles of the forearm all act upon digits, either separately or in common.

d. Acting upon digits.

(a'. — From humerus or forearm.)

There is only one digital flexor upon the front of the forearm. The superficial or "perforatus" flexor is confined to the hand, as the corresponding flexor of the toes is to the sole. Of extensors upon the back of the forearm there are, besides the one common to the fingers, two special ones for the thumb and little finger respectively.

Flexor digitorum communis (profundus s. perforans). — Lies between the radial and ulnar extensores carpi; a muscle of large size, flattened shape, and somewhat complicated structure. It has extensive origin, both from humerus and forearm bones. Its humeral origin corresponds with that of the extensor carpi radialis, but is a little lower down upon the inner condyle and more external; this part of the muscle is larger than the other; it has aponeurotic investment upon both sides, and mainly contributes to form the stout tendon that runs somewhat up in its substance, and is thus, as it were, embraced by two muscular valves. The tendon flattens at the palm, in a direction contrary to the flattening of the muscle above. The ulnar portion of the muscle arises from all of the upper three-fourths of the surface of the bone—excepting a small line along the ulnar ridge which is occupied by the origin of extensor carpi ulnaris — up to the

very tip of the olecranon; it is thus longer than, but not so broad nor strong as, the humeral portion, and is wholly muscular without tendinous intersection. It joins the other portion at the common tendon below.

Between these two portions, and partly separating them, a small distinct fusiform muscular belly lies embedded. It has tolerably definite and distinct origin from the little tubercle on the base of the humerus just internal to the ulnar facet; it runs along in the substance of the digital flexor for an inch or so, and then contracts into a delicate thread-like tendon that we traced distinctly to the wrist, and there lost without making out special insertion. We found what we take for the same muscle in the opossum (*D. virginianus*); there it has precisely the same disposition and relations. It cannot be flexor digitorum superficialis, because we find the latter confined to the palm; nor flexor longus proprius pollicis, since this last must be represented in the portion of the common flexor that corresponds to the first tendon going to the thumb. We take it to be palmaris longus.

The common flexor of the fingers splits at the palm into five, not four, equal and similar tendons. Morphologically speaking, we hold "flexor longus proprius pollicis," when this exists independently, to be merely a differentiation from the common "profound" or perforating set of flexing tendons. Here the deep flexor remains intact, and there can be no dissimultaneous motion of the thumb, even did the close webs permit it. The single great tendon passes the wrist flanked on either hand by the wrist extensors (radial and ulnar), filling up the depression between the two prominent carpal bones, to which the tendons of the muscles last named are attached. It fills the palm to a level, forming a thick indissoluble tendinous band, permeated with several small irregular gritty specks, like imperfect sesamoids—one for tendons of little and ring fingers, one for middle and index, with a thumb moiety lying a little to one side of the last. A little beyond the bases of the metacarpals, the tendon divides into five, as already stated. These pass each to the base of the ungual phalanx of a digit, bound down in their course, not only by the ordinary digital sheaths, but by a small stout transverse fibrous band opposite each node. Each perforates, as usual, a tendon of the superficial flexor, and has a lumbricalis, as noticed in detail below.

Extensor digitorum communis.—Arising from the outer condyle next after the origin of the flexor carpi radialis; a subfusiform, laterally flattened muscle wedged between the last named and the extensor minimi digiti, with only one border becoming superficial. With definite pointed origin from the very apex of the ectocondyle, it quickly becomes tendinous; opposite, or a little above the wrist, the tendon

grows broad, thin and flat, and expands still more upon the back of the hand. Individual tendons may of course be traced to the tips of the digits; but they are so blended in one common fascial expansion upon the back of the hand, and upon the digits are so intimately connected with the fibrous sheaths, that they require to be forcibly and somewhat arbitrarily cut apart. Extension of the digits is absolutely consentaneous, so far as this muscle is concerned.

In the muscle is formed a small, distinct, muscular belly, with a delicate abortive tendon, not traceable to definite insertion. This unquestionably represents one of the deep (special) extensors—either extensor indicis or of a pollical internode; more probably the former.

Extensor minimi digiti.—Lying next to the preceding, as large as it, and perfectly distinct; in greatest part superficial, overlying the last described, and itself partly overlaid by the flexor carpi ulnaris, a short, stout, spindle-shaped muscle arising from the ectocondylar tip, and passing to the tip of the little finger. Its tendon is very distinct to the back of the hand, where it partakes of the general fascial expansiveness, and is scarcely distinguishable except by arbitrary dissection.

The constancy of this muscle is as remarkable as that of the extensor longus proprius pollicis of the foot, and is specially interesting in such a case as the present, when proper thumb muscles abort or disappear. It goes far towards substantiating the antitypy that we hold exists between the little finger and great toe.

Extensor ossis metacarpi pollicis. "*Abductor pollicis longus.*"—While the foregoing extensors are superficial, this, like the supinator brevis, is deep-seated, being entirely overlaid above. It is the only special thumb muscle—others going to the internodes being wanting. It lies upon the back of both bones of the forearm, arising fleshy from both, but mostly from the ulnar shaft, its middle third, as high up as the elbow joint and insertion of anconeus; its radial origin is only from the head and a trifle of the shaft of that bone. The muscle becomes tendinous a little below the middle of the forearm, where its obliquity increases to enable it to gain the radial side of the limb; it passes under the tendon of the flexor carpi radialis, and over that of supinator longus, across the foot of the radius, and thence runs to the base of the first metacarpal, where it is more definitely inserted than the other extensor tendons are. From its insertion and the obliquity of its tendon, it is a pure abductor, or web-spreader, rather than an extensor.

Although this muscle is inserted into the base of a metacarpal, instead of into a digital internode, it is essentially one of the digital extensor set; and as explained at greater length below, we refer to the "*peroneus tertius*" of anthropotomy (a muscle that, in some animals,

becomes a pure extensor of the little toe) for its posterior antitype. We hold that the digital extensors of both members are, like the flexor sets, essentially two, a deep, or "long," "perforans," and a superficial, or "short," or "perforatus." Extensor minimi digiti manus, and extensor longus hallucis pedis are differentiations from one set, and mutually antitypic; while extensor indicis, and extensors of the pollical internodes, are representatives of the other set, corresponding to the short extensor that remains upon the instep in the human subject, but which, as in the opossum, may be carried up the leg as one of the peroneal group. "Peroneus tertius" is another of the same group, corresponding with extensor ossis metacarpi pollicis. We recur to the subject again in speaking of foot muscles.

(b'. — From carpo-metacarpus.)

There are no digital muscles, except the dorsal interossei, arising from the back of the hand; on the contrary, several are found upon the palm, among them the flexor digitorum perforatus, as well as the short special thenar and hypothenar muscles, the lumbricales, and palmar interossei.

Flexor digitorum sublimis s. perforatus. — This muscle lies wholly in the palm, as the corresponding "short" flexor of the toes of man does in the sole; and, like the same muscle of, for instance, the opossum's foot, it arises upon and from the common tendon of the "long" or profound flexor digitorum. It is a small muscle, in some danger of being overlooked without due care; but its tendons may be demonstrated to have the essential characters and relations of those of a perforatus set in the customary exhibition of the latter as a muscle of the forearm. It arises as a flat fleshy mass upon the palmar (superficial) aspect of the conjoined tendon of the deep flexor, and speedily splits into fascicles that terminate in delicate tendons that pass to the bases of the fingers, and are mostly inserted into the tendons of the deep flexor a little beyond; but the tendons also spread like two "perforatus" tendons, into an expansion joining the digital sheaths, on either side of tendons of the deep flexor, which are thus embraced in the usual way.

Lumbricales. — Four of the five tendons of the deep flexor muscle are accompanied and reinforced by four accessory muscles, that arise from the dorsal (interior) aspect of the conjoined tendon before it splits, and pass to be inserted as usual into the digital sheaths at the sides of the fingers.

Thenar and hypothenar muscles. — These are nearly alike, of small size, and not dissimilar in general aspect to interossei; but their mode of insertion exposes their character. The short special flexor of the thumb is a small, flat fasciculus arising pretty definitely from the most prominent carpal bone on the radial side, lying along the

same aspect of the palm, and distinctly inserted into the front of the base of the first phalanx of the thumb. This muscle is single, and not separable into adductor, abductor, etc.; but on the hypothenar side we find what we take to be both these muscles acting upon the little finger. An *abductor* (or short flexor?) arises rather broadly from the outer side of the pisiforme, and runs along the ulnar aspect of the fifth metacarpal, to a little beyond the base of the first phalanx of the little finger, where its tendon is lost in the digital sheath. An *adductor* is smaller, a mere thread, arising from the centre of the palm, and running along the inner side of the fifth metacarpal to terminate opposite the other on the side of the little finger.

In this animal, the thumb cannot be distinguished by any function that it has from the little finger; nor by any intrinsic physical character, except its being only two- instead of three-jointed; and the special muscles of these two digits are nearly identical. In "archetypal" condition we hold these digits to be physically identical, and their subsequent differentiation in mobility, direction of axis, number of joints, and muscles acting upon them, to be purely teleological. Originally we may perhaps hold the thenar and hypothenar muscles to be modified interossei, and to be represented each by a single muscle; though as a matter of fact we ordinarily have, from two to four (most commonly three; an adductor, abductor, and flexor brevis) muscles into which each interosseus may have been differentiated. It is interesting to observe, that in this case of the *Ornithorhynchus*, with thumb and little finger so similar, as far as function is concerned, what little difference in the number, etc., of special muscles there is, is in the favor of the little finger, a condition the reverse of usual.

Interossei. — Each of the digits except the two lateral ones has a palmar interosseus; the three are quite similar. They arise almost together from the middle of the palm, and divaricate thence upon the second and fourth fingers. They lie directly upon the palmar aspect of the metacarpals and proceed to split upon the basal phalanges of the fingers, terminating on either side on the digital sheaths. The dorsal are faintly developed.

IX. MUSCLES CONNECTING THE PELVIS WITH THE BODY. — Only one muscle actually passes from the body to be "inserted" in the pelvis, and this, in its action at any rate, is rather a muscle of the back. The numerous other body-muscles that have pelvic attachment, are only incidentally, as it were, connected with that arch, and really belong elsewhere, as to abdomen, perinæum, etc.

Psoas parvus. — Large, much exceeding the other. It arises from vertebral centra (except the last two lumbar) up to about the eighth

and ninth dorsal from below, and by digitations from the contiguous portions of ribs, especially a few of the lower ones. Its flattened tendon, dense and glistening, extends upward upon its anterior border. It has definite insertion into the pectinæal eminence.

X. MUSCLES OF THE POSTERIOR EXTREMITY.

On reflecting the skin and panniculus, the whole limb down nearly to the heel, is seen to be enwrapped in three large, broad muscles; on the outside lie the enormous *ectoglutæus* and the remarkably expanded biceps; on the other side lies the great *gracilis*, second only to the *glutæus* itself in size and strength.

a. Acting upon the femur.

Perhaps the most notable peculiarity is the absence of *glutæus maximus* from this group, this muscle's insertion being carried down to the leg below. *Psoas magnus* and *iliacus* are much blended, and have remarkably extensive fleshy insertion; the same may be said of the two smaller *glutæi*. We can find no trace of *scansorius* nor of *tensor fasciæ latæ*. There are three perfectly distinct *adductores femoris* besides the *pectinæus*, making a fourth. *Pyramidalis* is present; so are *quadratus femoris*, and the two *obturatores*, though the latter has no origin within the pelvis (being shut off by the ischio-coccygeal muscle) and does not develop *gemelli*. There is another little ischio-femoral muscle that we do not identify. Further details will be found under special heads of the muscles; but we may add here, that the femur, like the humerus, is extremely short, thick, strong, and irregular in superficies, contributing by its shape to forcible, rather than extensive, movements of the limb. It has scarcely a "neck;" its large head is embedded between two expanded trochanters of nearly equal size, projecting like ears or wings on opposite sides; below these the bone rapidly narrows to expand again into large condyles, whereof the outer is especially developed for extensive fibular connections. It is curious to find that there is no noticeable groove between the condyles in front, although there is a very large and well-formed patella; this is contrary to the general proposition, that depth of groove and size of patella are reciprocal or complementary, if, indeed, they have not a relation of cause and effect. The enormously expanded peronecranon reaches half way up the femur. The thigh is permanently abducted and rotated outward.

(a'. — From the body; "lóng.")

Dissection of *ectoglutæus* from the femoral group leaves only the following muscles to be considered in this connection:—

Psoas magnus. — Small, with distinct origin above, from the two lowest lumbar vertebræ; but inseparably blended, before passing the brim of the pelvis, with the *iliacus*. (Description resumed below.)

Pyriformis. — A thin flat triangular muscle that arises by three digitations from the fascia over the caudal vertebræ, and so, in effect, from the coccygeal spines themselves; it is wholly overlaid by the great glutæus; it lies, itself, upon lateral caudal muscles, proceeding directly transverse, narrowing as it goes, to be inserted by a thin narrow definite tendon into middle of femur behind, at foot of ectotrochanteric ridge, opposite the termination of the *glutæus minimus*. It abducts, and slightly rotates inward.

Quadratus femoris. — Below and behind the preceding, smaller, and ribbon-like. It arises from the two most prominent transverse processes of coccygeal vertebræ, in the septum betwixt the dorso-lateral and ischio-coccygeal caudal muscles, and proceeds outward and forward just behind the ectotrochanter, to be inserted into the middle of the back of the femur, opposite the insertion of the foregoing. It chiefly retroducts the thigh with slight abduction and inversion.

(b.) — From pelvic arch; "short.")

Iliacus. — With the usual position and relations; above of small size, owing to the dimensions and contour of the ilium; but below, after fusion with the *ps. magnus*, remarkable for its great fleshy mass, that fills the interval between the ilium and pectineal eminence, and its unusually extensive and fleshy insertion into the entotrochanter. After passing the hip-joint, which it directly overlies, it lies along the inner aspect of the femur, overlaid by the pectinæus, separated from the glutæi by interposition of rectus femoris. The insertion continues along the entotrochanter and thence down the bone nearly to the inner condyle. The usual actions of flexion and eversion are here very strongly displayed.

Glutæi (medius et minimus). — Though somewhat blended, still mostly separable, with due care, into an anterior (*minimus*) moiety, that is partly overlapped by a posterior and more superficial division (*medius*); both are completely separated from *ectoglutæus*. They arise together from the whole surface of the narrow ilium, from apex to acetabulum; and they are inserted, fleshy, *a*, *mesoglutæus*, chiefly, if not wholly, into the apex of ectotrochanter, and, *b*, *entoglutæus*, into the same trochanter and into the ridge descending thence for one-half inch down the shaft. These muscles are flexors from their origin and line of traction, while they also invert, from their insertion.

Adductor magnus. — The muscle which we thus homologize from its posterior position and extensive femoral insertion is smaller than either of the other adductors proper, although surpassing in size the pectinæus. It arises from the ischio-pubic ramus just in advance of the origin of the semi-tendinosus, by a rather long, thin, flat tendon; forms a thin, narrow triangle, passing outward to the thigh to be inserted in a line along the postero-internal aspect of the femur from

the middle of that bone quite to the inner condyle. Above, its insertion is in relation with that of the *pectinæus*; below, with femoral head of *gastrocnemius* and insertion of the *semi-tendinosus*. It is almost a pure extensor, having little adductor action, if any.

Adductor longus. — A prismatic muscle, with one surface superficial (except that it is covered by the *gracilis*), and one edge and two surfaces wedged down between *adductor magnus* and *brevis*. It arises by itself from the horizontal ramus of the pubis, a little toward the median line from the articulation of the marsupial bone, and very near the symphysis. It has definite abrupt insertion by a short tendon into the inner condyle, between the insertions of the last and the next. It is a pure adductor, and a strong one.

Adductor brevis. — A flattened fusiform muscle, lying anterior to the last, upon the *pectinæus*, which separates it from *ps. magnus* and *iliacus*. It arises from the process upon the horizontal ramus pubis at outer corner of articulation of the marsupial bone, and runs straight to a definite insertion, by a short, roundish tendon, into the inner condyle, just above the insertion of the last. A pure adductor.

Pectinæus. — A very small, flattened-oval muscle arising by a terete tendon from the deep notch at base (in front) of the remarkable pectinæal eminence, passing outward and backward upon the *psaos magnus*, overlaid by *adductor brevis*, to be inserted, by a rather long, narrow, thin, fascia-like tendon into the postero-internal ridge of the femur, near the middle of the bone. It is a *flexor*, and *everter* femoris, with action not very different from that of *psaos*, but feeble.

Of these four adductor muscles, it may be said briefly, that the two middle ones are adductors proper, the action of which may merge into either flexion or extension, in extreme postures of the thigh; that the first described is always extensor and barely adductor, while the last is always flexor and barely adductor.

It will be observed that the usual essential arrangement of four adductor planes is preserved, the hind extremity offering no such deviation in this respect as the fore does in its division of *coraco-brachialis* into two, and their high development; a circumstance highly favoring the reference of the four adductors to *coraco-brachialis* and *pectoralis major*, that has been made by Wilder.* The question whether the adductors are, or the *pectinæus* is, to be referred to *pectoralis*, and conversely, probably finally hinges upon determination of pubis as = *coracoid*, or as = *clavicle*. The present indication, from the extensive development of two *coraco-brachiales*, is, that these are represented in the hind limb by the adductors proper, leaving *pectinæus* as the correlative of the *pectoralis*.

*Op. cit. p. 33.

Three ischio-femoral muscles remain to be described; their determination may be attended with difficulty. One (*a*, see below) is pretty obviously *obturator externus*; another (*b*) appears like a partial segregation from *a*; the third (*c*) should represent *obturator internus*, although it is cut off from the inner surface of the ischium, has no radiation of tendon, and is unaccompanied by gemelli. All three proceed to the back part of the femur, at the expanded intertrochanteric surface, instead of conniving at a "digital fossa."

a. — With broad rounded origin from the whole outer surface of the ischium and obturator membrane, narrowing as it passes straight outward and forward across the back of the hip-joint to definite insertion (see above) between the insertions of *b* and *c*.

b. — Like a part of the preceding, and somewhat blended therewith, but mainly distinct. It arises fleshy from the base of the ischio-pubic ramus along and below the articulation of the marsupial bones, and from the upper margin of the obturator foramen; passes back of the hip-joint and entotrochanter to a broad, fleshy insertion into most of the expanded intertrochanteric space. This and *a* extend and evert the femur.

c. — Arises fleshy from the whole of the thickened concave posterior border of the ischio-iliac ramus, from tuber ischii to acetabulum; passes outward and forward across the back of the hip-joint to the ectotrochanter, where it is inserted fleshy into the border and back surface of that process just below its apex. Its action is similar to those of the two preceding.

In examining the operations of the muscles that collectively act upon the femur, there is probably not much to note, after we have seen the permanent abduction and eversion of the thigh. The general preponderance of extensors over flexors, etc., is in relation to the force of the backward stroke in swimming. The more interesting features of the hind limb are shown mainly from the knee downward.

b. Acting upon the leg.

The most remarkable thing about the crural muscles is the presence of the *intertibialis* (a feature unique in mammalian myology?). Probably the next most so, is the entrance of the enormous *ecto-gluteus* into the crural instead of the femoral group, its low insertion at the foot, and its connection there with a *caudo-tibial extensor*. Although the latter muscle occurs among marsupials, here we have it under special conditions. The *gracilis* is second only to the great *gluteus* in bulk, and sends a peculiar slip backward to the cloaca. The *biceps* is large and though rather unusually thin and fan-shaped, is exhibited in the normal condition of that muscle; that is, with only one (an ischial) head, and no femoral attachment — its bicipital dis-

position, with a femoral head, being an accident of higher mammals. The *rectus*, as usual among lower beasts, is discrete from the *vasti*; these are blended together, with no evident *cruræus*. The *sartorius* is a flexor cruris, and, therefore, not in its normal office; but it is interesting to note, that its origin is relegated to the pelvis, and placed lower down than in some animals, as marsupials, above this monotreme; whereas, a higher, even a vertebral origin would have been anticipated, in view of the animal's ornithic tendency. The motions of the leg at the knee-joint, and actions of the muscles, will be noted after the special descriptions.

(a'. — From the body; "long.")

We cannot demonstrate any satisfactory distinction between the *ectogluteus* and the "*flexor accessorius a caudâ ad tibiâ tendens*," nor between this last and the "*intertibialis*." With howmuchsoever difference in their origin, course, and function, the three blend in some or another part of their extent. They form collectively an enormous flexor cruris, effecting a powerful backward pull (extension) of the whole limb. *Ectogluteus* is also an outward rotator and abductor of the limb; the caudal muscle a direct retroductor (and flexor cruris), while the slip passing from one tibia to the other, is an adductor drawing the heels together under the tail, besides being a flexor cruris. The details of this singular arrangement, which probably, from its advantageous traction, acts more powerfully, for its size, than any other muscular apparatus of the limbs of mammals, are these:—

Ectogluteus arises along the median line over the back of the sacrum and several anterior coccygeal vertebræ, in apposition with its fellow, in a straight line from the apex of the ilium downward to a point on the tail opposite the origin of the panniculus. Except in being overlaid by the last named, it is wholly superficial, resting above upon the other two glutæi, the pyriformis, and the dorso-lateral caudal extensor; farther down, lying upon the last mentioned, and part of the biceps, from the origin of which, however, it is separated by the width of the tail at the part. The upper fibres run very obliquely backward; the others have successively more and more transverse direction, and finally the lowermost run outward and a little forward. At the posterior extremity of origin occurs an interval, equal to the distance between the spinous and the transverse processes of the coccygeal vertebræ; then a stout bundle of fibres—the *flexor accessorius*—takes fleshy origin from the tip of the transverse processes of two or three vertebræ, and soon blends with *glutæus* proper. From the anterior border of *flexor accessorius*, *intertibialis* becomes differentiated about an inch from the leg, and passes directly transverse across the tail below, rather more than an inch in front of the anus, to be continuous with its fellow of the other side; it is attached to the pannic-

ulus where it crosses the median line. The insertion of this extensive apparatus is rather diffuse, and may not always be exactly as we made it out in this specimen. Glutæus proper becomes tendinous, or rather fascial, dips among the tendons of the back of the leg just above the heel, and thus has indefinite insertion, but is mainly prolonged over base of the spur, and heel, to be continuous with plantar fascia. The caudal part, on the other hand, has definite insertion into the tibia; twisting for that purpose, much as latissimus or pectoralis major does, so that the most anterior fibres (those that give off the intertibialis) are inserted lowest down. The insertion is in the middle third of the tibia behind, for about half an inch, opposite the insertion of the gracilis. The plantar attachments doubtless cause the muscle to act somewhat as an extensor of the foot—in obvious subserviency to advantageous action in giving the back-stroke.

(b'. — From the pelvic arch: "long.")

Biceps. — The external or fibular flexor cruris is a single-headed broadly triangular muscle, without femoral origin. It arises definitely from the tuber ischii, at first overlaid by the ectoglutæus; as it emerges from under which, it rapidly widens into a broad and comparatively thin plane that spreads over nearly all the leg, in apposition, at first with the tibial flexores cruris that also arise from the ischiatric tuberosity, and afterwards with the great fibular head of the gastrocnemius and other peroneal muscles. Partly in consequence, very likely, of the burial of the fibula in muscle, the biceps has no actual insertion into that bone, except just at the upper margin of the spatulate peronecranon. Muscular fibres terminate, in a curved line corresponding to the outer border of the calf of the leg. In a broad dense aponeurosis that sweeps over and envelops the whole front of the leg, with final definite insertion into the crest of the tibia from the patella two-thirds way down the leg, besides sending below sundry fascial prolongations between the tendons of anterior tibial muscles. This actual insertion of the *outer* (fibular) flexor cruris into the *inner* bone of the leg occurs in marsupials also, as, for instance, in the *Didelphys virginiana*, where it offers a highly interesting analogy to the *ulnar* insertion of one foot of the biceps brachii of the same animal. The actions of the *Ornithorhynchus'* biceps cruris are several; firstly, it retroducts the femur and extends the whole limb; secondly, it is a flexor of the leg; and thirdly, it is a powerful external rotator of the limb below the knee, turning the heel directly towards, and the claws away from, the body. The mechanism of the knee-joint, as explained below, allows this action, which is furthered by the way the aponeurotic tendon of insertion of the biceps laps over the swelling muscles of the calf, as a band over a pulley.

Gracilis.—Of great size. Arises fleshy, in apposition with its fellow for the whole length of the symphysis pubis, and greater part of outer surface of marsupial bone. Above, it is connected with the symphyseal aponeurosis of the obliquus externus abdominis; below, with a slight tendinous intersection, it sends straight backward the peculiar slip that goes to the cloaca. The muscle passes nearly transversely outwards, overlying all the other tibial flexors as well as the femoral adductors. Its posterior border is curved and somewhat tucked under, while the anterior border is straight; the muscle converges and grows at the same time thinner, to be inserted by a short, flat, broad tendon into the shaft of the tibia, for half an inch along the middle third of the bone. Primarily, the gracilis is a strong direct adductor of the whole limb; next it flexes the tibia, and finally rotates the leg inward.

Semitendinosus and *Seminembranosus* have continuous origins and insertions, parallel and contiguous courses, and similar functions: neither displays the physical structure that led some one to encumber anatomy with two of the most unhandy and inept names in the science. Both are direct flexors of the leg, and extensors of the whole limb, with a little inwardly rotating action. The *one-half membranosus* is the posterior of the two; it has definite origin from the tip of the ischium next to the biceps; is of a flattened terete shape, taking straight course to the leg, where it has extensive fleshy insertion for half an inch along the upper third of the tibia, just to one side of its crest. The *one-half tendinosus*, has more extensive and chiefly tendinous, but also partly fleshy origin from the ascending ramus of the ischium, between the origin of the foregoing and that of the adductor. It forms a prismatic muscle, owing to its flat under and superficial, and bevelled posterior, aspects; the *one-half membranosus* resting on the latter. It converges abruptly to a point, with definite tendinous insertion into the head of the tibia, at the most internal and projecting point of the latter.

Sartorius.—Here its true office as an extensor cruris and flexor femoris is contravened, and we find the muscle, much as in man, at once a flexor of two consecutive segments. Its low, instead of high, pelvic, or even vertebral, origin has been already mentioned. It arises from the apex of the pectineal eminence, in connection with the insertion of the *psoas parvus*, by a round cord-like tendon; passes outward upon the inner aspect of the limb, overlying pectineus and adductors, expanding remarkably as it goes, into a flattened, triangular muscle. Narrowing somewhat, it becomes aponeurotic just below the internal condyle of the femur, and is attached to the naked space in front of the tibia above, though really continuous with the somewhat similar fascial expansion of the biceps. It is, firstly, an adduc-

tor of the whole limb; secondly, a flexor femoris; thirdly, a flexor cruris; and finally, it rotates the leg a little inward.

Rectus femoris. — Entirely distinct from the rest of the “triceps extensor cruris,” which, as a whole, is not very highly developed. Rectus has definite origin by a stout, flattened tendon from the bottom of the iliac shaft, just above and in front of the acetabulum. The tendon radiates upon the surface of the muscle, and helps to keep it discrete from vasti. The muscle enlarges below, forming a pyramidal belly that passes between and separates iliacus and glutæus minimus. Farther on, it partly separates in two; a superficial portion, the larger, has virtual insertion into the patella; the deep portion, smaller and thinner, runs down fleshy over the face of this sesamoid, to be inserted with the ligamentum patellæ into the head of the tibia by a fascial expansion. A pure extensor cruris.

Vasti. — There is no “cruræus,” although with the exercise of the ingenuity that anthropotomy has developed, such might perhaps be invented. The two vasti form a single fleshy mass of moderate size, arising from the whole of the broad anterior femoral surface, from the insertion of psoas and iliacus on one side to that of glutæi on the other. The insertion is fleshy, into the patella, its whole width. The great size of this bone, and its remarkably distinct ligament for tibial attachment, give it less appearance of a sesamoid than usual. The vasti are pure extensors.

Both crural bones articulate extensively with the femur; and the conformation of the knee-joint in other respects, is such, that the leg enjoys rotatory movements equivalent to pronation and supination, and more closely resembling those of the elbow than is usual in the mammalian series. The oar that the foot makes, like that of the hand, is feathered at the joint above. Examination of above described actions of muscles moving the leg will show how this is accomplished; while certain motions at the ankle, to be readily appreciated from the notice of the leg muscles that here follows, further the design of bringing the limb forward with the edge of the web cutting the water, and carrying it backward with directly opposed broad plantar surface.

Poplitæus. — The proper rotator of the leg is of large size, and, as usual, deep-seated at the back of the knee-joint and leg. It arises fleshy from the inner corner of the crest of the fibula for a third of an inch; passes obliquely across the joint, and downwards, to the tibia, gaining some fibres of origin from the articular head of the fibula as it passes that point; but we made out no femoral attachment. It is inserted fleshy into the broad flat space on the back of the tibia, just below its head.

If this muscle really is poplitæus, here we have it without femoral

relations, and more nearly resembling in its attachments, course and function, the "interosseus cruris" of some animals, which is not developed in the present instance.

This muscle is decidedly not to be referred to the pronator radii teres.

c. Acting upon tarso-metatarsus — from femur or leg, or both.

The great size of the spoon-shaped peronecranon, from which nearly all the muscles of the foot arise, either wholly or in part, effects (a) greater power of such muscles, in consequence of actual increase of contractile mass, (b) advantageous rotatory operation, and (c) a very peculiarly shaped calf. On the front and outer side of the leg, the muscles rather suddenly contract to tendons at about the middle; those behind run nearly to the heel; all are very closely packed above, while below, the tendons are much separated by intervention of fascial and adipose tissue.

We may note, at the outset, that "peroneus tertius" occurs here in its true character of extensor minimi digiti pedis — a common, if not the customary condition of the muscle in animals below the highest; our notion of its antitypic relations with a muscle of the fore limb is given further on. The digital extensor set is double in the leg; i. e., the deep set, that in man, etc., is restricted to the instep, here runs up the leg. In some marsupials, e.g., opossum, the same muscle is peroneal, and defects behind the malleolus externus before distributing its tendons to the digits. Here it comes directly down the front of the leg and is clearly displayed as one of the true digital extensors, corresponding to the special extensores pollicis and indicis, in the hand. Extensor longus hallucis is present and of usual characters.

Flexor tarsi tibialis; h. e., Tibialis anticus.—The innermost muscle upon the front of the leg; large; superficial; arising by two heads. The smaller of these takes fleshy origin from the tibial shaft in front, from its head half way down; and is divided by a cellular interspace from the other, the larger, head which arises from the patella and a corner of the peronecranon in apposition with the extensor hallucis. The two join and become tendinous at the middle of the leg; the stout tendon passes in front of the inner malleolus, most internal of any, to its customary insertion into the base of the first metatarsal. The usual action.

Extensor tarsi tibialis; h. e., Tibialis posticus.—A large, very deep-seated muscle upon the back of the leg, filling the wide interosseous space, but having no tibial origin. It consists essentially of two parts; the shorter and thicker of these arises from the articular head of the fibula, and a ridge thence two-thirds way down the tibial aspect of that bone; the longer and thinner part from the back of the shaft of the fibula and most of the posterior surface of the perone-

cranon. It is overlaid by the plantaris, has the flexor longus digitorum to the outside, and the popliteus to the inside. Its tendon passes behind the inner malleolus to be inserted at the most prominent point of the inner aspect of the tarsus.

Plantaris. — A muscle of great size, comparatively. It arises fleshy from the posterior surface of the peronecranon, and its crest, between popliteus and tibialis posticus, and lies in a sort of bed formed by the last named. It continues fleshy two-thirds way down the leg; then its stout tendon, instead of passing with tendo Achillis to the os calcis, glides behind the inner malleolus, and expands into a strong plantar fascia.

Gastrocnemius. — Of rather remarkable conformation; its two heads are widely separated, and very different in shape; one is much larger than the other. The larger arises fleshy from the outer one-half or two-thirds of the fibular crest, and immediately forms an immense bulging mass that rivals, proportionally, the human calf itself; this lies upon the outer side and back of the leg, mostly upon the fibular flexor of the toes. It forms a stout tendo Achillis at the lower third of the leg, with the usual calcaneal insertion. The tendon has aponeurotic expansion upon the outer surface of the muscle. The smaller head arises fleshy from the inner femoral condyle, at its back, just above the capsular ligament of the knee-joint. It is thick at first, but soon becomes flattened into a ribbon-like muscle that passes very obliquely outward down the leg, to join the outer gastrocnemius at the middle of the leg with a sort of tendinous intersection — one side being as it were partly laid over the outer gastrocnemius, the other directly continuous. This construction, though in evident relation to rotatory powers of the leg, is barely a foreshadowing of that complete separation of the two gastrocnemii, and presence of two tendones Achillis, that obtains in some marsupials.

Peroneus longus. — A large superficial muscle upon the antero-external aspect of the leg, lying upon "peroneus tertius" and extensor longus digitorum, in relation internally with extensor hallucis. It arises fleshy from the outer moiety of crest and adjoining anterior surface of the fibula; forms a thick spindle-shaped belly, and becomes tendinous just below the middle of the leg. Its tendon proceeds along the outer aspect of the outer malleolus, a little in front of it, if anything, rather than behind it, gains the side of the ankle in front, and dips below the base of the 5th metatarsal. It then, as usual, traverses a groove obliquely across the sole, along the conjoined heads of the metatarsals, to be inserted into the base of the 1st.

Extensor hallucis. — The next muscle to the *tibialis anticus*; a long, roundish, but somewhat compressed belly arising from a tubercle on the outer aspect of the tibial head, and from contiguous portions of the peronecranon. Its tendon, which forms about the middle of the

leg, passes at first obliquely across the middle of the instep, and thence more laterally to gain the great toe, upon the surface of which it runs to the base of the unguis phalanx. It is a large muscle, wholly superficial, and, like the *tibialis anticus*, is partly separable into tibial and fibular heads of origin.

Extensor "longus" digitorum. — Smaller than either of the muscles upon the direct front of the leg, with a short belly and a long tendon; it is deep-seated, covered over by the preceding, and in apposition with the peroneal muscles proper. Its origin is wholly fibular, by a short, stout tendon, from a tubercle on the articular head of the fibula, and it lies wholly upon this bone. Its long slender tendon passes a little obliquely down upon the fibula, then along the groove between the bone and the tibia, just internal to the tendon of the next described muscle. On the instep it spreads into a fan-shaped fascial expansion that covers most of the dorsum, and is then differentiated into 4 tendons that supply, in the usual way, all the digits except the great toe.

Extensor "brevis" digitorum. — This is the muscle that in man occupies the instep; here carried up the leg; not, however, as in opossum, etc., to form a peroneal muscle passing behind the outer malleolus, but coming obliquely down the leg in front, crossing the fibula below, gaining the groove between this bone and the tibia, alongside the tendon of the foregoing. The muscular part is the most deep-seated of any on the front of the leg, and the smallest of all; a thin little plane arising from, and lying upon the expanded surface of the fibula opposite and a little above the articular head of this bone. The tendon that it soon forms is *flat*, and, with the course just mentioned, spreads, after passing the ankle, into a large fan-shaped plane, similar to, and lying underneath the plane of *extensor longus*. It is difficult of being distinguished into tendons, but with some care may be demonstrated to proceed to all five digits, and nearly or quite to their tips. In its digital course, it is closely connected with the sheath of the toes, and it runs rather along their sides than directly upon their dorsal aspects.

Extensor minimi digiti. Peroneus tertius. — The third peroneal or flexor tarsi fibularis of anthropotomy is a muscle of considerable size, that lies upon the *extensor "brevis" digitorum*, on the front of the fibula, and is overlaid by the *p. longus*. It is a flattened strip that arises fleshy from the crest of the fibula and contiguous anterior surface, narrowing regularly as it descends, and becoming tendinous a little below the middle of the leg. Crossing the tendon of *p. longus*, its tendon gains the outer border of the foot, at base of the 5th metatarsal, and thence runs along the little toe to be inserted into the base of its unguis phalanx. It is an abducting extensor of that digit.

This muscle, which, in man, is inconsiderable and appears like an off-

set of the common long extensor of the digits arrested at the base of the fifth metatarsal, here appears in what we hold for its true character. It has the same disposition and relations in some marsupials. We consider it the antitype of the extensor ossis metacarpi pollicis. At first sight, especially in view of its running to the extremity of the little toe, one might think it rather referable, if to any of the thumb muscles, to one or both of the extensors of the pollical internodes, when these are present, as in man. But these last appear to be decidedly dismemberments of a common deep extensor set, of which the special extensor indicis is another; and these are already amply accounted for by the extensor brevis digitorum pedis.

Flexor digitorum longus (Abularis). — There is no tibial flexor of the toes; the fibular flexor gives off part of the large tendons that go to terminal phalanges, the others being supplied by a muscle of the sole, that occupies the situation of the human "flexor accessorius." The flexor is a very large muscle that arises fleshy from the outer aspect of the shaft of the fibula, its upper half, and thence up along the back surface of the ridge that runs up the crest; and from the outer corner of the crest itself; it is partially contained betwixt the gastrocnemius externus and the peroneus longus. At the lower third of the leg, it develops a stout tendon that runs some way upon its outer surface, giving a dense glistening aponeurotic investment. The tendon passes behind the middle of the heel, in a deep groove alongside the calcaneum, where it becomes flattened, and soon splits into only three tendons. Two of these, that appear to be the most direct continuations of the original tendon, run to the ungual phalanges of the first and second toes; the third divaricates more, and passes between the two heads of the flexor brevis minimi digiti to its insertion into the base of the ungual phalanx of the little toe. Thus the 3d and 4th toes are so far unsupplied with large tendons, from this muscle.

Flexor sublimis (brevis) digitorum pedis. — We should judge from its appearance in the specimen that it might be larger, and even supply more digits, than we found to be the case in this instance. It forms a short, flat, fleshy belly, lying upon, and arising wholly from, the flattened tendon of the foregoing, with no osseous origin. It divides below into two tendons only, that are lost in the digital sheaths of the 2d and 3d toes near their bases.

This appears to be the antitype of the muscle of the same name in the hand. The muscle has a similar disposition, and arises in the same way from the tendon of the main flexor, in the opossum, although in this animal it is carried half way up the leg.

Thus far, we have seen no tendon going to the 4th digit. This is supplied by a little muscle of the sole that lies in the position of flexor accessorius of anthropotomy, though decidedly not to be morphologically identified therewith. We hold it on the contrary to be

really a dismemberment of the long common fibular flexor, restrained to the foot, just as the muscle that sends the single tendon to the opossum's great toe is. Ordinarily, perhaps, in unguiculate mammals at least, there are *two* long deep digital flexors, one tibial, the other fibular; the distribution of the individual tendons of which is variable. Thus in man, one goes to the great toe alone, the other to all the rest of the digits; and the two seem to have, as it were, exchanged places, since their tendons cross to reach their respective destinations. In the next animal, viz., the gorilla, it is the *other* muscle that gives off the most tendons. In the opossum, for example, the flexor hallucis occurs, and is on its proper, viz., tibial, side of the leg; but its tendon aborts at the heel, being there fastened to the common tendon; and its place is supplied by a little plantar calcaneal muscle that crosses the foot obliquely and gives off a tendon as large as any from the common flexor; this tendon runs between the heads of the flexor brevis hallucis, and is inserted in the usual manner into the base of the distal phalanx of the great toe. Now in the *Ornithorhynchus* with only one long deep flexor digitorum, we have a similar arrangement, though with a little variation. The plantar dismemberment of the common long deep flexor digitorum forms a short, fleshy belly that arises from the side of the os calcis, and soon becomes tendinous, dividing into *two* tendons that pass to terminal phalanges of the 3d and 4th digits. These tendons are fully as large as those coming down from the leg, and have identical disposition upon the digits.

All that has just been said has reference only to the subdivisions of *one*—the long deep—set of digital flexors; that is, it is without bringing into the discussion the above described flexor "brevis" or *sublimis*. The latter corresponds to the muscle of the same name in the hand. The former (flexor longus digitorum) is so variously differentiated into two muscles and several tendons in the mammalian series, that it is safest, as well as most philosophical, to regard it, as a morphological integer, susceptible of varying dismemberments, which, as a matter of fact, supply different digits in different animals. The corresponding muscle of the hand is probably in most unguiculates single, with *five* identical tendons; when, as in man, it is differentiated into two, one of these is flexor longus pollicis, the other flexor digitorum profundus. In the foot, the muscle is probably usually divided into two that have, with different animals, different digital distribution, as just stated. It will be found best to distinguish these two simply as respectively 'fibular,' and 'tibial,' without reference to the particular digits that either supplies.*

*In drawing antitypes of the deep digital flexors of *man*, it must be remembered, that, as above mentioned, the human flexores *tibialis* and *fibularis* have, as it were, changed places, so that flexor hallucis is the correlative of the flexor digitorum profundus, and flexor longus digitorum pedis of the flexor proprius pollicis.

(b.' — From tarso-metatarsæ.)

Although the little calcaneal muscle, just discussed, really lies wholly on the sole, yet it belongs to the last group, and we only now come to muscles of the digits that may be properly called tarso-metatarsal. As usual, these are more numerous and bulky upon the plantar than upon the dorsal aspect of the foot. They are chiefly the special muscles of the great and little toes. We find but one for the hallux, while on the other hand, three may be demonstrated upon the little toe. In this animal, there is absolutely no specialization of external form, etc., of the thumb and great toe; while these digits are, if anything, less favored with special muscles than either the little finger or little toe is. Here, at any rate, nothing but the difference in the number of the internodes stands in the way of the correlation of the little toe with the thumb, and conversely, of the great toe with the little finger.

Flexor brevis hallucis. — A very small and insignificant muscle lying upon the first metatarsal; it arises near the base of this bone, and is inserted by two heads into either side of the base of the great toe, with a pair of sesamoids. We can distinguish no other muscle upon the ball of the great toe. It directly flexes.

Flexor brevis minimi digiti. — A short, plump muscle, almost entirely fleshy, that arises from the os calcis, passes down over the next muscle, divides into two heads, between which runs a tendon of the long fibular flexor digitorum; they are inserted into either side of the base of the little toe.

Abductor minimi digiti. — A flattish, fleshy muscle, lying along the outer border of the foot, filling up what would otherwise be a depression between the os calcis and the head of the 5th metatarsal, arising from the former, and inserted into the outer aspect of the basal phalanx of the little toe.

Adductor minimi digiti. — A well developed, distinct, long, flat strip of muscle arising near the head of the 3d metatarsal at the centre of the sole, and passing obliquely outward and forward to be inserted into the inner side of the base of the 1st phalanx of the little toe.

This muscle seems to be the largest and outermost of a series of four that diminish successively from the 5th to the 2d toe. They arise near together, along a line corresponding to the passage of the tendon of the peroneus longus across the sole; and each is inserted into the inner side of the base of a digit. They are apparently spreaders of the web, like the interossei from which, however, they are wholly distinct.

The *plantar interossei* lie wholly upon, instead of between, the metatarsals, and are well developed. They embrace the bases of the 2d - 4th digits. The dorsal were not specially examined; they appeared to be inconsiderable.

It is only just to ourselves to say, in concluding a necessarily im-

perfect article, that the circumstances under which it was prepared deprived us of the advantage of consulting Meckel's memoir, or anything else that may have been published upon the subject, except the short notice in *Owen's C. A. & P. V.*, iii, pp. 2-7. This frank statement of our limited resources, so far from being made with any desire of disarming criticism, is intended to invite correction of errors we may have committed in identification of muscles; and this, we trust, a certain accuracy of descriptive detail will render comparatively easy.

We desire to record here our present conviction, that the identification, with entire accuracy, of the singularly modified muscles that lie upon the sauropsidan shoulder-girdle of this mammal, will go far toward establishing, in myology, the hypothesis of Antero-posterior Symmetry that is maintained by Wyman, Wilder, and the writer.

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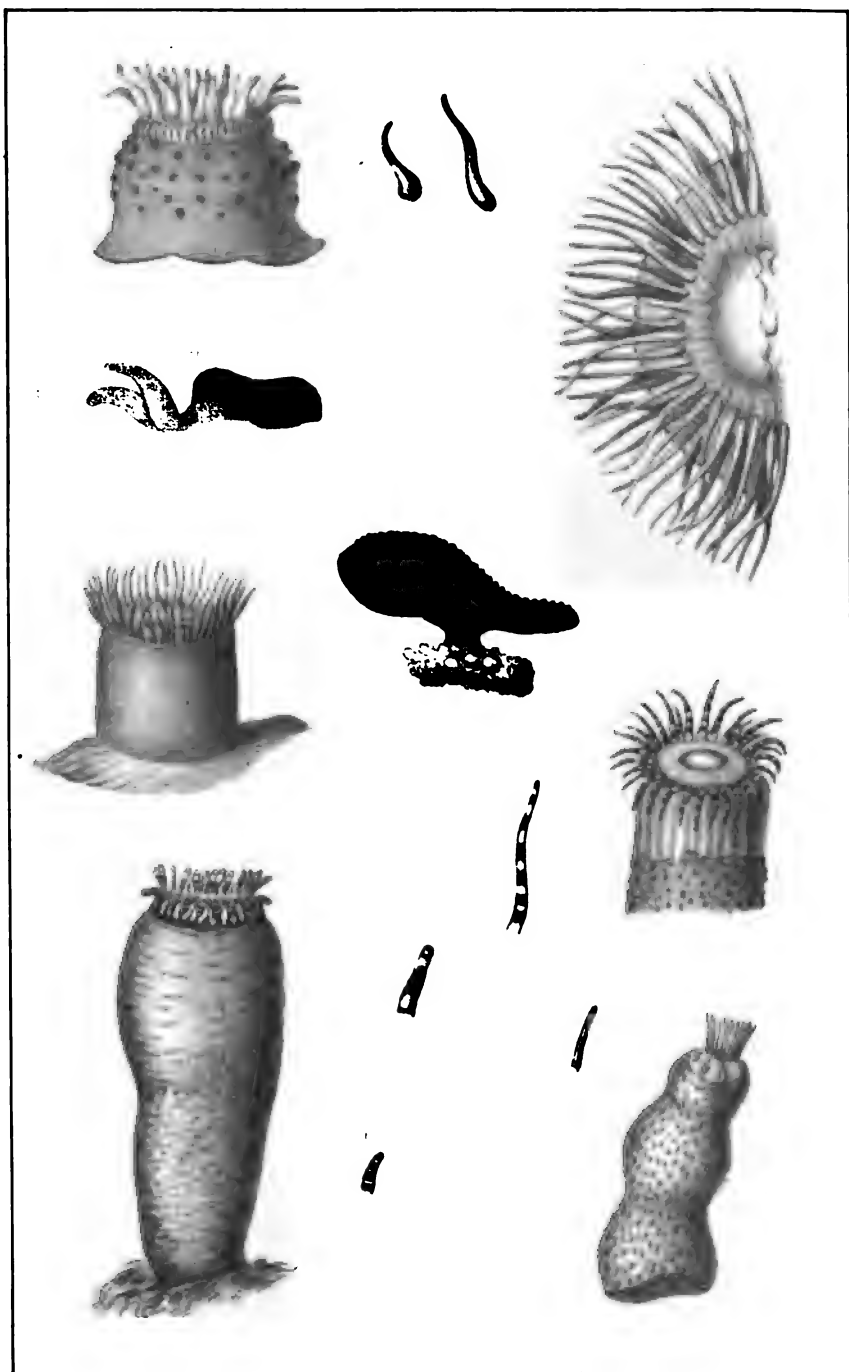
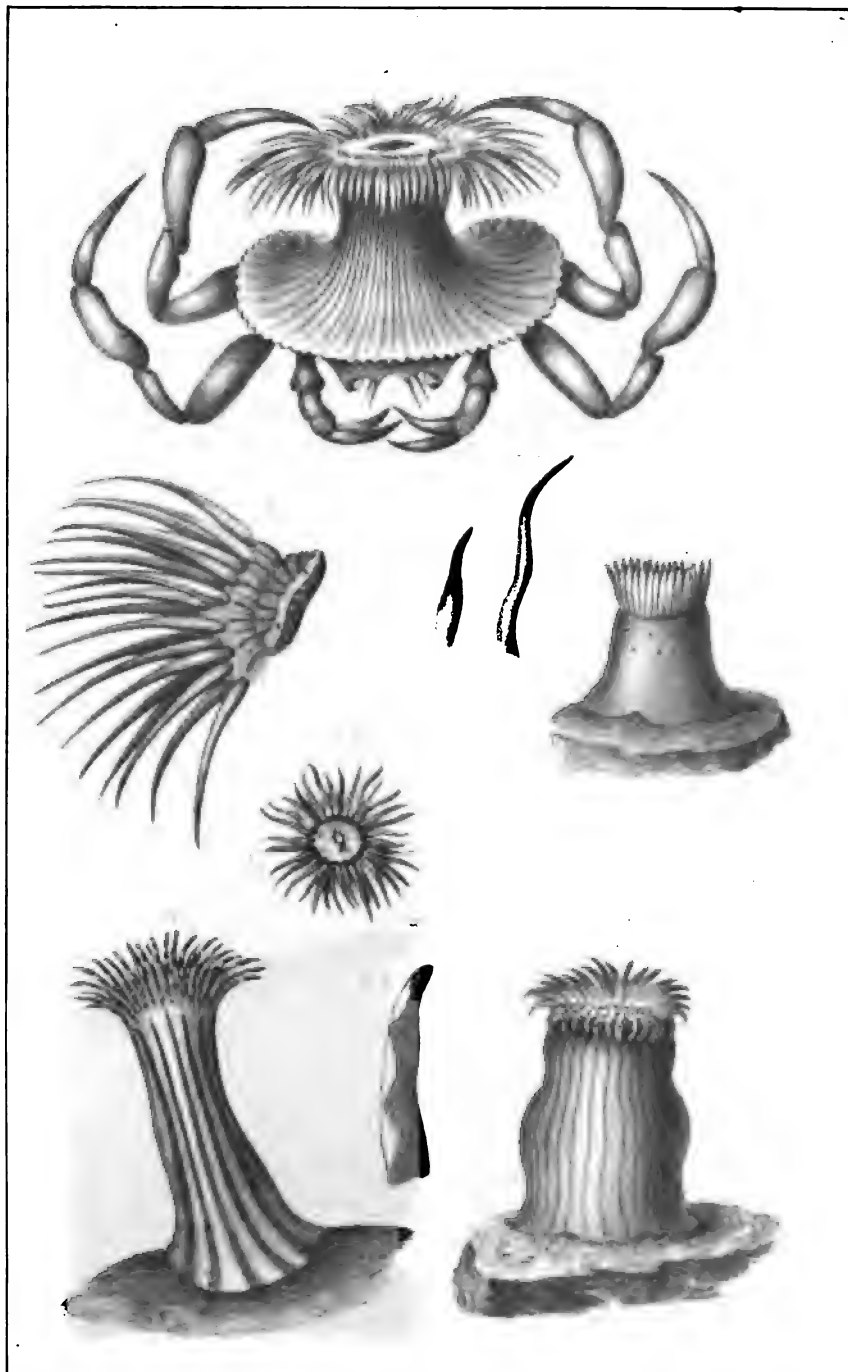


Fig. 1. *Hydra*. Fig. 2. *Hydra*. Fig. 3. *Hydra*. Fig. 4. *Hydra*. Fig. 5. *Hydra*. Fig. 6. *Hydra*. Fig. 7. *Hydra*. Fig. 8. *Hydra*. Fig. 9. *Hydra*. Fig. 10. *Hydra*. Fig. 11. *Hydra*. Fig. 12. *Hydra*. Fig. 13. *Hydra*. Fig. 14. *Hydra*.



Polychaeta, Echinodermata, etc.

